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CRC HOT-START AND DRIVEAWAY DRIVEABILITY PROGRAM AT HIGH AND INTERMEDIATE TEMPERATURES USING GASOLINE-ALCOHOL BLENDS

August 1988

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CRC HOT-START AND DRIVEAWAY DRIVEABILITY PROGRAM AT HIGH AND INTERMEDIATE TEMPERATURES USING GASOLINE-ALCOHOL BLENDS

(CRC PROJECT No. CM-118-85)

Prepared by the

1985 Volatility Analysis Panel

of the

CRC Volatility Group

August 1988

Automotive Vehicle Fuel, Lubricant, and Equipment Research Committee

of the

Coordinating Research Council, Inc.

ABSTRACT

A cooperative CRC test program was conducted at Failure Analysis Associates Test Track in Phoenix, Arizona, from September 4 through October 4, 1985. The program investigated the hot-start driveability of thirteen 1985 model vehicles with eight hydrocarbon-alcohol blends and two hydrocarbon-only gasolines at nominal ambient temperatures of 90°F and 70°F. The driveability procedure was modified to emphasize conditions which may cause fuel foaming. Carburetted, throttle-body-injected (TBI), port-fuel-injected (PFI), and port-fuel-injected turbocharged fuel systems were represented in the vehicle fleet. Ambient temperature effects were highly significant for carburetted and throttle-body-injected vehicle fuel-metering systems and for the total fleet. Carburetted vehicles were more sensitive to fuel properties and ambient conditions than fuel-injected vehicles. PFI vehicles consistently gave lower demerits than TBI vehicles. Low-volatility fuels gave significantly better hot-start driveability at high temperatures than the high-volatility fuels. It should be noted, however, that tests of high-volatility fuels at high temperatures (nominal 90°F) were not representative of conditions found with commercial fuels. The only significant difference due to oxygenate addition was the poorer performance of carburetted vehicles on low-volatility-matched gasoline-ethanol and gasoline-methanol:TBA blends. Vehicle performance was generally poorer on oxygenated fuels than on hydrocarbon-only fuels. JES

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I. INTRODUCTION

The use of oxygenates as gasoline blending components has increased during the past few years, due primarily to their octane benefits. As a result, the Coordinating Research Council (CRC) has sponsored programs to study the volatility effects of oxygenated fuels on vehicle performance. These programs included a vapor lock program at high and intermediate temperatures[1] and a driveability program at intermediate temperatures[2]. The objectives of the 1985 program were to determine the effects of hydrocarbon-alcohol blends on hot driveability performance over a wide range of volatilities at nominal ambient temperatures of 90°F and 70°F. Tests were conducted at the intermediate temperatures (nominally 70°F) to assess the effects of alcohol use over a wide range of temperatures as well as to evaluate fuel foaming, an over-rich fuel mixture condition.

The program was conducted from September 4 through October 4, 1985, at Failure Analysis Associates Test Track located in Phoenix, Arizona. Fuel performance was evaluated using the CRC Hot-Start Driveability Procedure modified to create test conditions that might produce fuel foaming. Vehicles were tested on a high- and a low-volatility fuel series. Each series contained five fuels: one hydrocarbon-only fuel, two gasoline-ethanol blends, and two gasoline-methanol:t-butyl alcohol (1:1) blends. The hydrocarbon-alcohol blends all contained 3.5 percent oxygen. Limited testing was also conducted on a high-volatility fuel containing 5.0 percent oxygen as ethanol.

Appendix A lists the participants of the Data Analysis and the Fuel Analysis Panels. Appendix B lists the participants of the on-site test program. Appendix C outlines the proposed program as approved by the CRC Volatility Group.

II. SUMMARY

Conclusions based upon results of the program are:

- Ambient temperature effects were highly significant for carburetted and throttle-body-injected (TBI) vehicle fuel-metering systems and the total fleet. Temperature effects were not found to be significant for port-fuel-injected (PFI) fuel-metering systems.

- Carburetted vehicles were found to be more sensitive to fuel properties and ambient conditions than fuel-injected vehicles.

- PFI vehicles gave lower demerits than TBI vehicles for every comparison made; however, the differences between TBI and PFI fuel-metering systems were not significant at the 90 percent confidence level.

- Low-volatility fuels gave significantly better hot-start driveability at the higher temperatures than the high-volatility fuels. Tests of high-volatility fuels at high temperatures (nominal 90°F), however, were not representative of conditions found with commercial fuels. Test fuels were selected to improve the ability to distinguish effects of the fuel properties.

- The performance of vehicles was generally poorer on oxygenated fuels; however, this was not significant at the 90 percent confidence level because of high test variability and limitations on the testing procedure.

- The only significant difference due to oxygenate addition was the poorer performance of low-volatility-matched gasoline-ethanol and gasoline-methanol:TBA (1:1) blends on carburetted vehicles.

- For carburetted vehicles, no significant differences were found in driveability performance of ethanol and methanol:TBA containing fuels.

- All reported differences are believed to be valid, even though the specifications of the low-volatility fuels were not precisely met.

- Although the 0-55 mph wide-open-throttle maneuvers were added to the driveability procedure to search for fuel foaming, fuel foaming was not detected during this test program.

- Analysis of demerits assigned during the 0-55 mph wide-open-throttle portion of the procedure for sensitive carburetted vehicles suggests that vapor lock was encountered during these maneuvers. Such vapor lock responded as expected to fuel volatility and temperature.

III. TEST VEHICLES

The test fleet consisted of thirteen 1985-model vehicles, described in Table I. Five of the vehicles were provided by the vehicle manufacturers: Ford supplied three, and American Motors and Nissan each supplied one. The remaining eight vehicles were leased from local rental agencies or automobile dealerships. Twelve of the vehicles were passenger cars, and one was a pickup truck. All of the vehicles had air conditioning and Federal emissions control devices, and all except the pickup truck were equipped with automatic transmissions. The emission and fuel systems were not checked.

Fuel tank drain fittings were installed on all but the Ford vehicles by Failure Analysis Associates; the Fords were received with the tank drain fittings already installed. The participants installed tank drain hoses and valves on-site, as well as thermocouples for measuring fuel temperatures.

All vehicles were equipped with thermocouples to measure tank fuel and underhood fuel temperatures. Underhood thermocouples were located in the fuel supply lines just upstream of the carburetors or fuel-injection systems. In addition, thermocouples were placed in the carburetors just above the bowl vents in the air horns to detect the presence of fuel foaming in the vents.

Manifold vacuum gauges and accelerometers were installed for use in performing various maneuvers in the driving procedures.

IV. TEST FUELS

The properties of the test fuels used in this program are shown in Table *II*, with individual participant fuel analyses presented in Appendix D. The fuel design for this program specified two fuel sets at two volatility levels. The test fuels were selected to improve the ability to distinguish effects of the fuel properties. The low-volatility fuels (Fuels 1-5) were targeted to meet a $T_{V/L=20}$ of 133°F, a nominal ASTM Class B fuel specification. The high-volatility fuels (Fuels 6-10) were targeted to meet a $T_{V/L=20}$ of 105°F, a nominal ASTM Class E fuel specification. Each fuel set contained one hydrocarbon-only fuel, two gasoline-methanol:TBA (1:1) blends, and two gasoline-ethanol blends. All hydrocarbon-alcohol blends were blended to contain 3.5 percent by weight oxygen. Within each set, one gasoline-methanol:TBA blend and one gasoline-ethanol blend were targeted to have the same T_{10}, T_{30}, T_{50}, and T_{90} percent evaporation temperatures and $T_{V/L=20}$ as the hydrocarbon-only fuel. For the purposes of this report, these fuels are defined as "matched-volatility" fuels. The data in Table II indicate that in some instances, these targets were not always met.

Difficulties were encountered with Fuels 2 and 4, and it was necessary to *compromise between meeting the* $T_{V/L=20}$ specification and meeting the T_{10} and T_{30} specifications. Priority was given to matching the distillation temperatures for T_{10} and T_{30}. The other gasoline-methanol:TBA and gasoline-ethanol blends were blended to only match the $T_{V/L=20}$ specification. For the purposes of this report, these *fuels are defined as "modified-splash"* fuels. The complete set of fuel specifications is shown in the program plan, presented in Appendix C.

Two additional fuels were blended on-site. Ethanol was added to Fuel 10 to provide Fuel 11, and ethanol was added to Fuel 5 to provide Fuel 12. Both Fuels 11 and 12 contained 5.0 percent by weight oxygen. Provisions had also been made to cross-blend high- and low-volatility fuels of like fuel description to provide fuels of intermediate volatility. So few runs were made on the 5 percent oxygen fuels and the intermediate-volatility fuels that no analysis was attempted.

Reid vapor pressure (RVP) of each fuel drum used in the program was checked on-site using an automatic RVP machine. No cases of suspect drum fuel quality were detected. Fuel samples drawn from the vehicle fuel tanks at three points during each run were also checked for RVP. There has been no attempt made to account for fuel tank weathering in the data analysis. RVP results of the fuel tank samples are included in the raw data presented in Appendix F.

An alternate method to measure vapor-to-liquid ratio of hydrocarbon-only fuel and hydrocarbon-alcohol blends by a bomb method may be found in Appendix E. Attempts to use this method for on-site testing of the $T_{V/L=20}$ of fuel samples proved to be unsuccessful, because the test procedure assumed linearity between the 100°F and 130°F test temperatures. Some of the fuel samples were outside of this bracket, and subsequent testing by ASTM showed that linearity did not exist when it was necessary to extrapolate the data. The validity of the data was thus in question; therefore, no data are presented in this report.

V. TEST FACILITIES

The test facilities, shown in Figure 1, were located at the Failure Analysis Associates test track in Phoenix, Arizona. The test course consisted of:

- a two-mile, newly-paved, limited-access, oval track used for the test maneuvers and the five-mile stabilization run;
- two local, two-lane, asphalt roads used for the ten-mile stabilization run;
- a seven-mile section of interstate expressway used for the fifteen-mile warmup.

Access to the expressway was approximately one mile away via local roads.

Temporary soak shelters to accommodate four vehicles, a refrigerated fuel storage room, and a refrigerated trailer van were located adjacent to the track. The roofless soak shelters, twelve feet by twenty-four feet, and constructed of plywood with plastic end curtains, were used for both the ten-minute idle soak and the twenty-minute key-off soak. A building used for office space was also located nearby. Concrete pits were available to install vehicle tank drains and thermocouples.

Air temperature was recorded on the data sheets using a dry-bulb thermometer at the beginning of each test.

On-site fuel vapor pressure (RVP) analysis was performed using an automatic RVP instrument supplied by Southwest Research Institute. The fuel samples were stored in the refrigerated fuel storage room until they were transported to the RVP instrument in an ice-chest.

A refrigerated, controlled-temperature trailer was used for fuel blending and dispensing. Transfer lines from the fuel drums were connected to pumps immediately outside the refrigerated trailer.

A portable computer was provided by CRC for on-site data recording. The on-site data entry was used to facilitate data review by the participants, as well as data analysis during and after the program.

Testing for vapor-to-liquid ratio of gasoline by the proposed bomb method was conducted at the General Motors Proving Grounds, located in Mesa, Arizona.

VI. TEST PROCEDURE

The 1985 CRC Volatility Program used a hot-start and driveaway test procedure which was modified from previous programs. This procedure incorporated portions from both the 1975 and the 1982 CRC High-Temperature Driveability Programs. The procedure also included a test for carburetor foaming, a longer city-traffic simulation, and performance after a refueling stop. The procedure is described in detail in the program plan, presented in Appendix C. Briefly, it consists of the following:

A. A prescribed warmup cycle

B. Refueling procedure and restart

C. Wide-open-throttle 0-55 mph accelerations, followed by a five-mile cruise

D. Ten-minute idle soak, followed by part-throttle maneuvers

E. City traffic 0-10 mph and 0-25 mph cycles

F. Constant vacuum acceleration, followed by a ten-mile stabilization

G. Twenty-minute key-off soak

H. Hot-start, followed by part-throttle accelerations

The entire driveability procedure categorized vehicle malfunctions according to cranking time, idle quality, hesitation, stumble, foaming, surge, backfire, and stalls (acceleration and deceleration). The severity of each malfunction is evaluated as trace, moderate, or heavy. A sample data sheet is also presented in Appendix C.

VII. TEST DESIGN

The program was designed to test ten fuels and twelve vehicles at two nominal temperatures of 90°F and 70°F. Replicate runs were also planned, as time permitted. The fuels were designed to allow blends of intermediate volatility to be tested.

Due to the daily ambient temperature conditions, only 194 high-temperature and 75 intermediate-temperature tests were conducted. The average ambient temperature for the high-temperature phase of the program was 91.7°F; the average ambient temperature for the intermediate-temperature phase was 73.9°F. A summary of the raw data is presented in Appendix F. A sample computer sheet shows where within the test cycle thermocouple temperatures were recorded and fuel samples taken for determination of RVP.

The on-site vehicle testing was conducted using four test crews of three people each: a rater, an observer, and a warm-up driver. Each test crew was initially assigned to test three vehicles chosen at random. At the end of the second day of testing, vehicles were reassigned to each crew on the basis of vehicle performance severity. These vehicle reassignments were minimal and generally resulted in all test crews testing at least one critically performing vehicle. These vehicles were defined to establish a priority for replicate testing; i.e., replicates would be run first on the critically performing vehicles. The program was designed for each test crew to perform five tests per day; however, due to ambient temperature conditions, the test crews were not always able to meet this target.

Tests were conducted at the nominal temperature of 70°F, primarily to assess the effects of alcohol use over a wide range of temperatures as well as to better define conditions which lead to fuel foaming; i.e., an over-rich fuel condition in the fuel delivery system. Of the results reported for the seventy-five intermediate-temperature tests, no instances of fuel foaming were detected. A lack of high ambient temperature days limited the ability to completely define the driveability of the critical vehicles with the use of various cross blends.

VIII. DISCUSSION OF RESULTS

A. Introduction

Average TWD's are presented in Table III for twelve of the thirteen vehicles and ten of the twelve fuels tested at high temperatures. Similar data are shown in Table IV for the fuels tested at intermediate temperatures. The vehicles are subdivided into three fuel-delivery systems: carburetted, throttle-body-injected (TBI), and port-injected (PFI). Vehicle 12 was not obtained until late in the program; thus, there was not sufficient time to test it with all fuels. Vehicle 12 was, therefore, not included in the data analysis. Only Fuels 6, 8, 9, and 10 were used for the intermediate-temperature analysis because the majority of the other fuels were not tested in all twelve vehicles.

B. Method of Analysis - Analysis of Variance

Analysis showed that the TWD data are not normally distributed. It was found that the square root of the TWD's is more normally distributed, as is the distribution of errors for the square root of the TWD's. The square root of the TWD's was, therefore, used for all tests of significant effects.

At high temperatures, the significant effects were determined by performing analysis of variance using all of the data for the twelve vehicles and ten fuels, including the replicate data. At intermediate temperatures, the significant effects were determined by performing analysis of variance using all of the data for the twelve vehicles and four fuels (Fuels 6, 8, 9, and 10) tested. Because no data were obtained for Vehicle 9 on Fuel 9 at intermediate temperatures, the TWD's and test temperature for this combination were estimated as 45 and 74°F, respectively, for analysis purposes.

The analysis methods and data sets used in much of the data analysis are described in detail in Appendix G for each analysis performed. The PROC GLM program available from Statistical Analysis System (SAS)[3,4] was used to analyze the data. The following sections discuss the significant effects, greater than or equal to 90 percent confidence, that were found.

C. Volatility Level

The effect of volatility on hot-start and driveaway driveability performance at high-temperature conditions is shown in Figure 2. As shown, the low-volatility fuels had significantly better driveability performance than the high-volatility fuels. It should be noted, however, that tests of high-volatility fuels at high temperatures (nominal 90°F) were not representative of conditions found with commercial fuels.

The volatility effect at intermediate temperatures was not determined due to the incomplete block of data.

D. Oxygenate Type

Hydrocarbon-only fuel was compared with gasoline-ethanol blends and gasoline-methanol:TBA blends in three distinct categories - (1) low-volatility fuels at high-temperature conditions, (2) high-volatility fuels at high-temperature conditions, and (3) high-volatility fuels at intermediate temperature conditions. For each of these three categories, data were analyzed for the total fleet and by fuel system type: carburetted, port-fuel-injected (PFI), and throttle-body-injected (TBI). Results are tabulated in Table V.

For low-volatility fuels at high temperatures, carburetted vehicles had poorer driveability on the hydrocarbon-alcohol blends than on the hydrocarbon-only fuel, and both alcohol types had approximately the same driveability. There was no significant difference in the driveability performance of fuels in PFI or TBI vehicles. The significantly poorer driveability performance of the total fleet on the hydrocarbon-alcohol blends was due mainly to the performance of the carburetted vehicles.

For high-volatility fuels at high-temperature conditions, there were no significant differences in driveability performance for any of the hydrocarbon-alcohol blends in the fleet or in any of the various fuel system subsets. The high average demerits for the total fleet on all fuels was due to the influence of the carburetted vehicles.

For high-volatility fuels at intermediate-temperature conditions, the only significant difference was between the hydrocarbon-only fuel and the gasoline-ethanol blend for the total fleet. A rigorous comparison cannot be made with the gasoline-methanol:TBA blend because of an incomplete block of data.

E. Fuel Delivery System Effects

Driveability performance was evaluated as a function of fuel system type in three categories: (1) low-volatility fuels at high temperatures; (2) high-volatility fuels at high temperatures; and (3) high-volatility fuels at intermediate temperatures. Results are shown in Table VI as carburetted versus fuel-injected vehicles and TBI versus PFI vehicles. As expected for all three categories, PFI vehicles gave statistically better driveability performance than TBI vehicles, and both had statistically better performance when compared to the carburetted vehicles.

F. Fuel Foaming

The test procedure specified various maneuvers which were used to evaluate vehicles for fuel foaming. Fuel foaming is defined as the formation of foam or bubbles in the fuel delivery system and carburetor. The result is a fuel-rich power loss (fuel foaming) that is very similar to a fuel-lean power loss (vapor lock) in vehicle performance. Even trained raters cannot distinguish the difference without some instrumentation. Under fuel foaming conditions, fuel is released through the internal bowl vent. For this reason, a thermocouple was placed in the space above the carburetor bowl vent to indicate when foaming did occur. A decrease in temperature is observed when foaming occurs. The temperature decrease is caused by fuel evaporation from the thermocouple. This defines a fuel-rich malfunction rather than a lean malfunction.

In this test program, there were no recorded instances of foaming on any of the test vehicles.

G. Volatility Adjustment Effects

Modified-splash blends were compared to matched-volatility blends to see if the type of volatility adjustment affected driveability performance. Fuels were compared in three categories: (1) low-volatility fuels at high-temperature conditions; (2) high-volatility fuels at high-temperature conditions; and (3) high-volatility fuels at intermediate-temperature conditions. For each of these three categories, data were analyzed for the total fleet and by fuel system type: carburetted; port-fuel-injected (PFI); and throttle-body-injected (TBI). Results of analyses are shown in Table VII. Of all the differences shown in the table, only one was judged significant. That occurred in the high-volatility, high-temperature fleet matched-volatility blends.

H. Fuel Comparisons

The following comparisons were made for each volatility series at high- and intermediate-temperature conditions: (1) hydrocarbon-only fuel versus each hydrocarbon-alcohol blend (four comparisons); (2) matched-volatility alcohol blend versus modified-splash alcohol blend (two comparisons, one each for gasoline-ethanol blends and gasoline-methanol:TBA blends); (3) matched-volatility gasoline-methanol:TBA blend versus matched-volatility gasoline-ethanol blend; and (4) modified-splash gasoline-methanol:TBA blend versus modified-splash gasoline-ethanol blend. Results are shown in Table VIII and summarized below.

Low-volatility fuels at high-temperature conditions:

- For carburetted vehicles, the matched-volatility gasoline-methanol:TBA blend (Fuel 2) and the matched-volatility gasoline-ethanol blend (Fuel 4) performed significantly poorer than the hydrocarbon-only fuel (Fuel 1). Although the difference between the matched-volatility gasoline-ethanol blend (Fuel 4) and the hydrocarbon-only fuel (Fuel 1) is shown to be significant for the total fleet, it should be noted that this result is due to the overwhelming effect of five of the six carburetted vehicles.

- The modified-splash gasoline-methanol:TBA blend (Fuel 3) also showed poorer driveability performance than the hydrocarbon-only fuel (Fuel 1), but the result was not significant.

- No significant differences in driveability performance were noted for any of the comparisons in PFI or TBI vehicles, when PFI and TBI vehicles were considered as separate categories.

High-volatility fuels at high-temperature conditions:

- Comparisons for PFI vehicles showed that hydrocarbon-only fuel (Fuel 6) had significantly better driveability performance than the matched-volatility gasoline-ethanol blend (Fuel 9).

- No significant differences in driveability performance were noted for comparisons with carburetted and TBI vehicles, and the total fleet.

High-volatility fuels at intermediate-temperature conditions:

- No significant differences in driveability performance were noted for any of the comparisons in carburetted, TBI, and PFI vehicles, or for the total fleet.

I. Sensitive Carburetted Vehicles

References to Table III and average TWD values in Table VIII indicate that performance of the carburetted vehicles is poorer than either PFI or TBI vehicles, and that any appreciable difference among fuels is the result of differences in performance observed in five of the six carburetted vehicles (Vehicle 10 performed relatively well). In these vehicles, many of the demerits were accumulated during the three wide-open-throttle (WOT), 0-55 mile-per-hour accelerations immediately after refueling. These high fuel-demand-rate maneuvers are very likely to suffer driveability malfunctions due to vapor locking conditions. In order to account for the degree to which vapor lock incidence might have influenced demerit totals, and to determine the extent to which the lower-than-specification $T_{V/L=20}$ values of the matched-volatility hydrocarbon-alcohol blends at the low-volatility level (Fuels 2 and 4) may have contributed to the poorer performance of these fuels, averages were recomputed for four sensitive carburetted vehicles. (Vehicle 10 was deleted because performance of this car was relatively good, and Vehicle 3 was deleted because it had an in-tank fuel pump not suspected of being prone to vapor lock fuel delivery problems.)

Table IX shows the four-vehicle average (Vehicles 1, 4, 7, and 11) TWD at high and intermediate temperatures for each of the ten fuels from Tables III and IV. Also shown are the average WOT TWD values for the five 0-55 WOT maneuvers included in the driving schedule that might be prone to vapor lock incidence. The difference in these two values (or "net TWD") shown are the average demerits accumulated during the lower fuel-demand portion of the traffic driveaway portion of the driving schedule. The values for the high-temperature portion of the program are plotted as a function of the front-end volatility of each of the fuels as expressed by $T_{V/L=20}$ in Figure 3.

The upper portion of the figure indicates the observed TWD. Lines have been drawn between each of the five fuel pairs of low and high volatility of like-fuel description; i.e., Fuels 1 and 6 are the hydrocarbon-only fuels. Each of the lines indicates a fair slope and, therefore, response of TWD to front-end volatility. On this basis, it would seem that the higher TWD values noted for the matched-volatility hydrocarbon-alcohol blends (Fuels 2 and 4) at the low-volatility level could be due in large part to the failure of these two fuels to achieve the specified $T_{V/L=20}$ value of 133°F.

Included in the TWD are demerits that were accumulated in five 0-55 MPH, WOT maneuvers in the driving schedule. These high fuel-demand-rate maneuvers, particularly the three accelerations immediately following the refueling, are susceptible to vapor locking problems. Shown in the lower portion of Figure 3 are the average TWD accumulated on each fuel during the WOT maneuvers as a function of $T_{V/L=20}$. A single line appears to represent the data fairly well; and it is not surprising that $T_{V/L=20}$ provides a good fit to the data, nor is it surprising that vapor lock may occur using fuels with $T_{V/L=20}$ of 105°F in carburetted cars at 90°F test conditions.

The middle section of Figure 3 shows the Net TWD (TWD minus WOT TWD) which represents the demerits accumulated during the lower speed traffic maneuvers of the driving cycle. Again, lines have been drawn between the low-volatility and high-volatility fuel of each fuel pair. The slopes of three of the five curves indicate very minor, if any, dependence of Net TWD on $T_{V/L=20}$ and no reason to believe that the higher Net TWD values associated with the matched-volatility hydrocarbon-alcohol blends (Fuels 2 and 4) in the low-volatility fuels are associated with their lower $T_{V/L=20}$ values. Also, since the matched-volatility hydrocarbon-alcohol blends (Fuels 2 and 4) were generally lower in mid-range volatility than the modified-splash hydrocarbon-alcohol blends (Fuels 3 and 5), there is no reason to suspect that fuel volatility has more than minor effects on Net TWD, leaving the higher demerit levels of the matched-volatility hydrocarbon-alcohol blends (Fuels 2 and 4) unexplained.

For continuity, Figure 4 displays the demerit sources for the intermediate-temperature data. Again, the Net TWD line, which can only be drawn for the hydrocarbon-only category (Fuels 1 and 6), shows very little dependence on $T_{V/L=20}$, and the hydrocarbon-alcohol blend demerit levels are very similar to the hydrocarbon-only fuel.

Although these data are for four sensitive vehicles, and responses in driveability performance of these vehicles to fuel changes greatly influence the all-carburetted and fleet average values, data are very limited. Most of the data shown represent a single run in each vehicle with each fuel; therefore, care should be taken in drawing conclusions from this data subset.

J. Malfunction

The percentage of total weighted demerits for each driving cycle malfunction is tabulated in Tables X and XI for high-temperature and intermediate-temperature testing, respectively. For the high-temperature testing, hesitations and stumbles accounted for 62 percent of the demerits. Nineteen percent of the TWD's were driving stalls, and the remaining nineteen percent were distributed among the other driving malfunctions. For the four fuels used in the intermediate-temperature analyses, 45 percent of the TWD's were stumbles. The other 55 percent were from idle roughness and stalls, hesitations, surges, and driving stalls.

K. Temperature Effects

The program was designed to measure ambient temperature and fuel tank temperatures at four intervals during the test cycle for each test run. Table XII shows the average demerits, ambient temperature, and average fuel tank temperatures for Fuels 6, 8, 9, and 10. These fuels were the only fuels tested at both temperatures. The relationship between demerits and ambient or tank temperatures is shown to be about three demerits per °F in Table XII. This agrees with a value of 2.95 demerits per °F calculated from a regression analysis of demerits versus ambient temperature using individual data points. No attempt was made to adjust demerits based upon temperatures in the preceding analyses.

REFERENCES

REFERENCES

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3. SAS Institute, Inc., "SAS User's Guide: Basics, Version 5 Edition," 1985.

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T A B L E S

AND

F I G U R E S

TABLE I

TEST FLEET

Manufacturer	Model	Displacement, liters	Fuel System
American Motors	Alliance	1.7	Throttle-Body Injected
Chrysler	Reliant	2.2	Carburetted
Chrysler	New Yorker	2.2	Port-Injected Turbo
Ford	LTD Wagon	3.8	Carburetted
Ford	Ranger	2.3	Port-Injected EFI
Ford	Tempo	2.3	Throttle-Body Injected
General Motors	Buick Century	3.0	Carburetted
General Motors	Skylark	2.8	Carburetted
General Motors	Camaro	5.0	Carburetted
General Motors	Skylark	2.5	Throttle-Body Injected
General Motors	Buick Park Avenue	3.8	Port-Injected
Toyota	Supra	2.8	Port-Injected
Nissan	Pulsar	1.6	Carburetted

All vehicles were from the 1985 model-year with air conditioning and automatic transmission, except the Ford Ranger which had a manual transmission.

TABLE II

AVERAGES OF FUEL ANALYSES PERFORMED BY INDIVIDUAL PARTICIPANTS
(Drum Retain Samples)

	Low Volatility					High Volatility				
Fuel:	HC* 1	MVM* 2	MSM* 3	MVE* 4	MSE* 5	HC* 6	MVM* 7	MSM* 8	MVE* 9	MSE* 10
Specific Gravity @ 60/60	.753	.747	.766	.808	.755	.735	.753	.746	.759	.740
Distillation, °F										
@ IBP	89	99	105	90	97	76	80	82	79	83
@ 5% Evap.	110	117	124	114	119	86	94	90	92	93
@ 10% Evap.	128	128	132	131	131	94	101	103	100	104
@ 15% Evap.	145	138	139	147	139	104	110	111	110	113
@ 20% Evap.	162	151	146	160	144	120	122	122	124	127
@ 25% Evap.	177	168	156	168	149	133	129	131	137	135
@ 30% Evap.	190	188	170	189	153	156	146	142	150	144
@ 35% Evap.	201	205	182	213	158	172	160	153	156	151
@ 40% Evap.	210	216	192	229	171	189	181	169	172	156
@ 45% Evap.	218	224	200	233	194	199	195	183	172	164
@ 50% Evap.	226	231	207	238	211	210	212	198	211	184
@ 55% Evap.	233	237	215	242	221	217	222	210	236	209
@ 60% Evap.	240	240	220	246	229	225	235	222	242	221
@ 65% Evap.	247	248	226	253	235	231	242	231	257	230
@ 70% Evap.	255	254	231	260	243	242	255	239	269	238
@ 75% Evap.	266	263	237	270	255	250	264	249	281	247
@ 80% Evap.	281	282	242	288	268	267	283	263	294	261
@ 85% Evap.	304	305	255	305	295	291	299	285	310	284
@ 90% Evap.	336	330	281	327	334	336	336	326	337	328
@ 95% Evap.	381	363	351	349	378	387	379	378	383	376
End Point	428	436	411	400	421	425	425	421	419	420
RVP, psi, @100°F	10.1	9.8	8.2	12.6	9.0	15.7	15.9	15.0	16.2	15.2
$T_{V/L=20}$, °F	136.0	128.0	133.8	123.5	132.5	103.7	102.3	104.7	102.3	104.5
vol % Alcohol - MeOH	0	4.21	4.24	-	-	0	4.28	4.63	-	-
- EtOH	0	-	-	9.13	9.35	0	-	-	9.29	9.89
- TBA	0	4.79	4.84	-	-	0	4.81	4.88	-	-

*HC = Hydrocarbon-Only Fuel
MVM = Matched-Volatility Gasoline-Methanol:TBA Blend
MSM = Modified-Splash Gasoline-Methanol:TBA Blend
MVE = Matched-Volatility Gasoline-Ethanol Blend
MSE = Modified-Splash Gasoline-Ethanol Blend

TABLE III

SUMMARY OF HIGH-TEMPERATURE DRIVEABILITY PERFORMANCE

TOTAL WEIGHTED DEMERITS*

Vehicle Number	HC** Fuel 1	MVM** Fuel 2	MSM** Fuel 3	MVE** Fuel 4	MSE** Fuel 5	HC** Fuel 6	MVM** Fuel 7	MSM** Fuel 8	MVE** Fuel 9	MSE** Fuel 10	Avg.
Carburetor											
1	16	106	104	82	41	200	232	211	205	176	137
3	34	44	49	71	40	348	201	167	338	149	144
4	91	103	104	103	64	150	237	230	162	187	143
7	130	161	106	213	177	142	139	221	164	118	157
10	0	20	44	4	20	28	5	30	45	23	22
11	45	152	20	132	36	113	156	48	152	70	92
Average	52	<u>98</u>	71	<u>101</u>	63	163	162	151	178	120	116
TBI											
2	0	0	0	12	1	8	27	5	2	10	6
8	10	9	27	0	33	39	27	13	25	62	25
9	42	37	30	85	34	69	126	82	110	77	69
Average	17	15	19	32	22	39	60	33	46	50	33
PFI											
5	13	8	7	12	42	0	61	11	33	92	28
6	3	1	0	8	0	10	4	14	7	3	5
13	0	0	0	0	0	0	0	0	16	0	2
Average	5	3	2	7	14	3	22	8	<u>19</u>	<u>32</u>	12
12-Vehicle Average	32	53	41	<u>60</u>	40	92	101	86	105	80	69

* Data in some instances may represent the average of replicate tests.
** HC = Hydrocarbon-Only fuel
MVM = Matched-Volatility Gasoline-Methanol:TBA Blend
MSM = Modified-Splash Gasoline-Methanol:TBA Blend
MVE = Matched-Volatility Gasoline-Ethanol Blend
MSE = Modified-Splash Gasoline-Ethanol Blend
(_) = Indicates demerits are statistically different from hydrocarbon-only fuel demerits at the 90% confidence level.

TABLE IV

SUMMARY OF INTERMEDIATE-TEMPERATURE DRIVEABILITY PERFORMANCE

TOTAL WEIGHTED DEMERITS*

Vehicle Number	HC** Fuel 1	MVM** Fuel 2	MSM* Fuel 3	MVE** Fuel 4	MSE** Fuel 5	HC** Fuel 6	MVM** Fuel 7	MSM** Fuel 8	MVE** Fuel 9	MSE** Fuel 10	Avg.***
Carburetor											
1	7	-	-	-	0	154	207	98	61	150	116
3	71	-	-	-	-	176	-	49	97	94	104
4	54	-	-	-	0	42	200	21	38	83	46
7	18	-	-	-	-	32	-	20	8	0	15
10	4	-	-	-	-	12	30	19	28	13	18
11	113	-	-	-	-	117	-	91	154	41	101
Average	44	-	-	-	0	89	146	50	64	64	67
TBI											
2	-	-	-	-	-	0	3	1	8	0	2
8	-	-	-	-	16	8	56	15	8	12	11
9	-	-	-	-	-	110	24	25	(45)+	25	51
Average	-	-	-	-	-	39	28	14	20	12	21
PFI											
5	-	-	-	-	-	0	19	0	6	10	4
6	4	-	-	-	0	18	9	12	1	1	8
13	8	-	-	-	-	28	-	0	1	0	7
Average	6	-	-	-	-	16	-	4	3	4	6
12-Vehicle	-	-	-	-	-	58	14	29	38	36	40

* Data in some instances may represent the average of replicate tests.

** HC = Hydrocarbon-Only Fuel
MVM = Matched-Volatility Gasoline-Methanol:TBA Blend
MSM = Modified-Splash Gasoline-Methanol:TBA Blend
MVE = Matched-Volatility Gasoline-Ethanol Blend
MSE = Modified-Splash Gasoline-Ethanol Blend

*** Average of Fuels 6, 8, 9, and 10.

\+ Estimated value.

(_) Indicates demerits are statistically different from hydrocarbon-only fuel demerits at the 90% confidence level.

TABLE V

AVERAGE DEMERITS BY OXYGENATE TYPE

	Hydrocarbon-Only Fuel	Gasoline-Methanol:TBA Blend*	Gasoline-Ethanol Blend*
High-Temperature Conditions			
Low-Volatility	(Fuel 1)	(Fuels 2 & 3)	(Fuels 4 & 5)
- Carburetted	52	(84)	(82)
- TBI	17	17	(27)
- PFI	5	2	10
- Fleet	32	(47)	(50)
High-Volatility	(Fuel 6)	(Fuels 7 & 8)	(Fuels 9 & 10)
- Carburetted	163	156	149
- TBI	39	46	48
- PFI	3	15	26
- Fleet	92	94	93
Intermediate-Temperature Conditions			
High-Volatility	(Fuel 6)	(Fuels 7** & 8)	(Fuels 9 & 10)
- Carburetted	89	(98)	64
- TBI	39	(21)	16
- PFI	16	9	3
- Fleet	58	(49)	(37)

* Average of matched-volatility and modified-splash blends.

(_) Indicates demerits are statistically different from hydrocarbon-only fuel demerits at the 90% confidence level.

** Incomplete Block of Data

TABLE VI

AVERAGE DEMERITS BY FUEL SYSTEM TYPE

	Fuel System		Breakdown of Fuel Injection	
	Carburetted	Fuel-Injected	PFI	TBI
High-Temperature Conditions				
Low-Volatility (Fuels 1-5)	77	14	6	21
High-Volatility (Fuels 6-10)	155	31	17	46
Intermediate-Temperature Conditions				
High-Volatility (Fuels 6,8,9 & 10)	67	14	6	21

(_) Indicates demerits are statistically different from carburetted demerits at the 90% confidence level.

(=) Indicates demerits are statistically different from PFI demerits at the 90% confidence level.

TABLE VII

AVERAGE DEMERITS BY TYPE OF VOLATILITY ADJUSTMENT

	Modified-Splash Blends*	Matched-Volatility Blends**
High-Temperature Conditions		
Low-Volatility	(Fuels 3 & 5)	(Fuels 2 & 4)
- Carburetted	67	99
- TBI	20	24
- PFI	8	5
- Fleet	41	57
High-Volatility	(Fuels 8 & 10)	(Fuels 7 & 9)
- Carburetted	136	169
- TBI	42	53
- PFI	20	20
- Fleet	83	103
Intermediate-Temperature Conditions		
High-Volatility	(Fuels 8 & 10)	(Fuels 7 & 9)
- Carburetted	57	64
- TBI	13	20
- PFI	4	3
- Fleet	33	38

* Modified-splash blends - Hydrocarbon-alcohol blends that were adjusted by butane back-out to match $T_{V/L=20}$ to the hydrocarbon-only fuels.

** Matched-Volatility Blends - Hydrocarbon-alcohol blends that were matched in distillation and $T_{V/L=20}$ to the hydrocarbon-only blends.

TABLE VIII

AVERAGE DEMERITS BY INDIVIDUAL FUEL

	Hydrocarbon-Only Fuel	Matched-Volatility Gasoline-Methanol:TBA Blend	Modified-Splash Gasoline-Methanol:TBA Blend	Matched-Volatility Gasoline-Ethanol Blend	Modified-Splash Gasoline-Ethanol Blend
High-Temperature Conditions					
- Low-Volatility	(Fuel 1)	(Fuel 2)	(Fuel 3)	(Fuel 4)	(Fuel 5)
Carburetted	52	$\underline{98}$	71	$\underline{101}$	63
TBI	17	$\underline{15}$	19	$\underline{32}$	22
PFI	5	3	2	7	14
Fleet	32	$\underline{53}$	41	$\underline{60}$	40
- High-Volatility	(Fuel 6)	(Fuel 7)	(Fuel 8)	(Fuel 9)	(Fuel 10)
Carburetted	163	162	151	178	120
TBI	39	60	33	46	50
PFI	3	22	8	$\underline{19}$	32
Fleet	92	101	86	$\underline{105}$	80
Intermediate-Temperature Conditions					
- High-Volatility	(Fuel 6)		(Fuel 8)	(Fuel 9)	(Fuel 10)
Carburetted	89	-	50	64	64
TBI	39	-	14	20	12
PFI	16	-	4	3	4
Fleet	58	-	29	38	36

(_) Indicates a significant difference from the hydrocarbon-only fuel at the 90% confidence level.

TABLE IX

AVERAGE TWD SOURCES FOR FOUR SENSITIVE CARBURETTED VEHICLES (Vehicles 1, 4, 7, and 11)

	Low-Volatility Fuels					High-Volatility Fuels				
Fuel:	1	2	3	4	5	6	7	8	9	10
High-Temperature Conditions:										
TWD	70.5	130.5	83.5	132.5	79.5	151.25	191.0	177.5	170.75	137.75
WOT TWD	15.0	10.5	21.0	27.25	19.5	49.5	76.5	70.5	58.5	57.25
Net TWD	55.5	120.0	62.5	105.25	60.0	101.75	114.5	107.0	112.25	80.5
Intermediate-Temperature Conditions:										
TWD	45.25	--	--	--	--	86.25	--	57.5	62.25	68.5
WOT TWD	7.5	--	--	--	--	31.5	--	13.5	6.0	29.0
Net TWD	37.75	--	--	--	--	54.75	--	44.0	59.25	39.5

TABLE X

PERCENTAGE OF TOTAL WEIGHTED DEMERITS* FOR EACH MALFUNCTION

- HIGH TEMPERATURE

(Average of 12 Vehicles)

			Idle		Driving				
Fuel	Init. Start	Restart	Rough	Stall	Hesit.	Stumble	Surge	Back-fire	Stall
1	0	0	9.7	0	35.5	35.5	3.2	0	16.1
2	0	0	9.4	0	24.5	39.6	7.5	1.9	17.0
3	0	0	9.5	7.1	26.2	26.2	4.8	0	26.2
4	0	0	6.6	4.9	44.3	27.9	4.9	0	11.5
5	0	0	11.1	0	42.2	22.2	4.4	4.4	15.6
Average Fuels 1-5	0	0	9.3	2.4	34.5	30.3	5.0	1.3	17.3
6	0	0	5.4	5.4	18.3	30.1	8.6	1.1	31.2
7	0	0	9.8	5.9	25.5	35.3	3.9	1.0	18.6
8	0	0	5.6	6.7	38.2	29.2	6.7	0	13.5
9	0	1.0	6.7	5.7	22.9	32.4	3.8	0	27.6
10	1.2	0	8.5	8.5	29.3	39.0	3.7	0	9.8
Average Fuels 6-10	0.2	0.2	7.2	6.4	26.8	33.2	5.3	0.4	20.1
Average Fuels 1-10	0.1	0.1	8.2	4.4	30.7	31.7	5.2	0.8	18.7

* When more than one malfunction occurs in a driving maneuver, only the malfunction giving the highest weighted demerits is counted.

TABLE XI

PERCENTAGE OF TOTAL WEIGHTED DEMERITS* FOR EACH MALFUNCTION - INTERMEDIATE TEMPERATURE

(Average of the Number of Vehicles Tested Per Fuel)

			Idle		Driving				
Fuel	Init. Start	Restart	Rough	Stall	Hesit.	Stumble	Surge	Back-fire	Stall
6	0	0	8.6	12.1	15.5	50.0	5.2	0	8.6
8	0	0	7.1	10.7	21.4	50.0	10.7	0	0
9	0	0	5.7	11.4	22.9	40.0	5.7	0	14.3
10	0	0	5.7	5.7	5.7	40.0	5.7	0	37.1
Avg.	0	0	6.8	10.0	16.4	45.0	6.8	0	15.0

* When more than one malfunction occurs in a driving maneuver, only the malfunction giving the highest weighted demerits is counted.

TABLE XII

SUMMARY OF AVERAGE TOTAL WEIGHTED DEMERITS, AMBIENT TEMPERATURE, AND FUEL TANK TEMPERATURE MEASUREMENTS

	Fuel 6	Fuel 8	Fuel 9	Fuel 10	Average
High-Temperature Conditions					
TWD's	92.17	89.25	104.92	79.67	91.50
Ambient Air Temp., °F	89.88	90.88	91.75	91.02	90.88
Tank Temp., °F	102.54	103.54	103.83	104.15	103.52
Intermediate-Temperature Conditions					
TWD's	58.16	29.25	37.92	35.75	40.27
Ambient Air Temp., °F	74.38	75.17	67.00	79.75	74.07
Tank Temp., °F	91.74	87.04	84.16	86.30	87.31

TWD 91.50-40.27 = 51.23

Ambient Temperature 90.88-74.07 = 16.81°F

Tank Temperature 103.52-87.31 = 16.21°F

TWD's/Ambient Temperature = 3.05 Demerits/°F

TWD's/Tank Temperature = 3.10 Demerits/°F

FIGURE 1

FAILURE ANALYSIS ASSOCIATES TEST TRACK

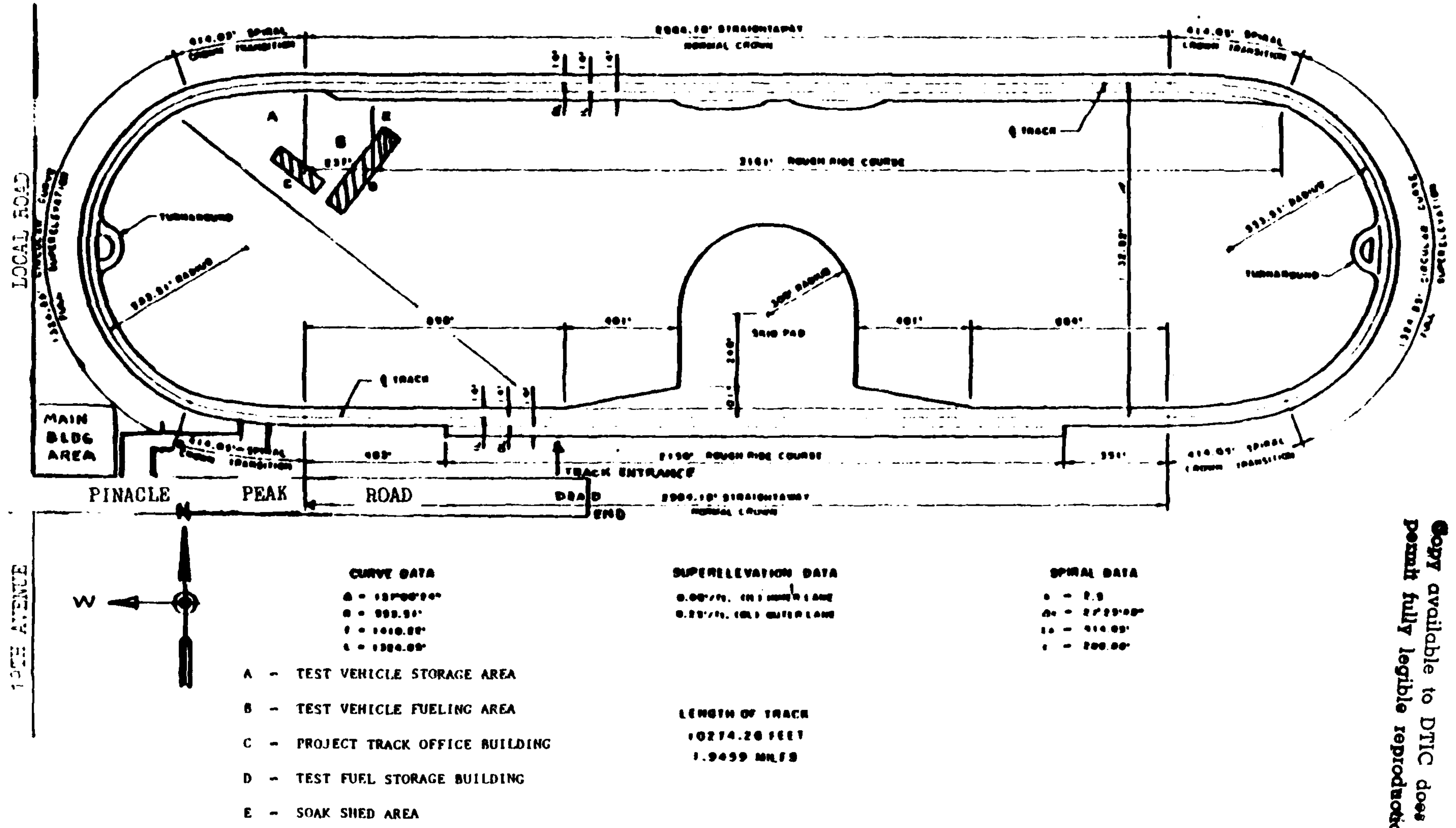


FIGURE 2

HOT-START AND DRIVEAWAY DEMERITS
HIGH-TEMPERATURE DATA

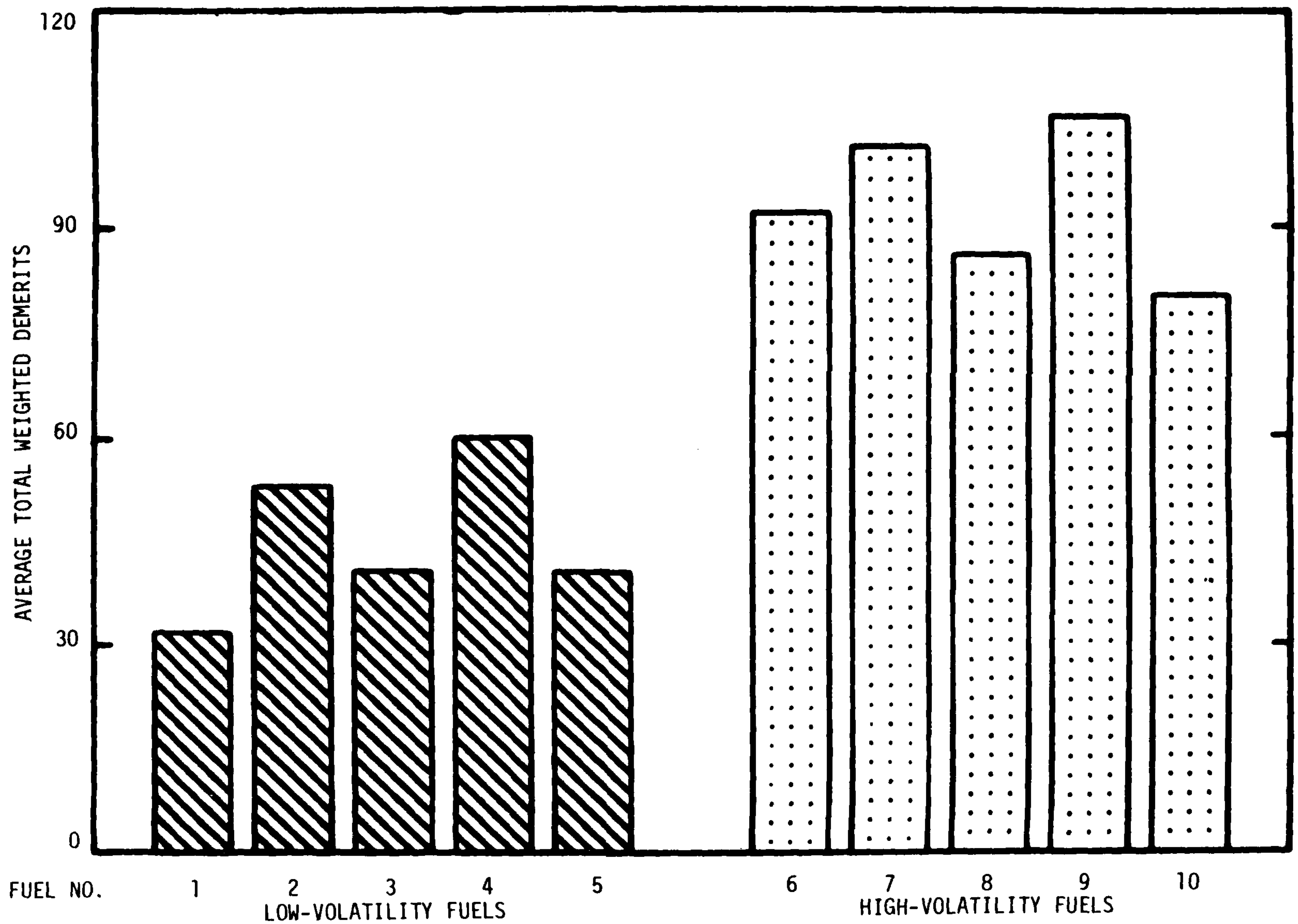


FIGURE 3

TWD SOURCES

FOUR SENSITIVE CARBURETTED CARS AT HIGH TEMPERATURE

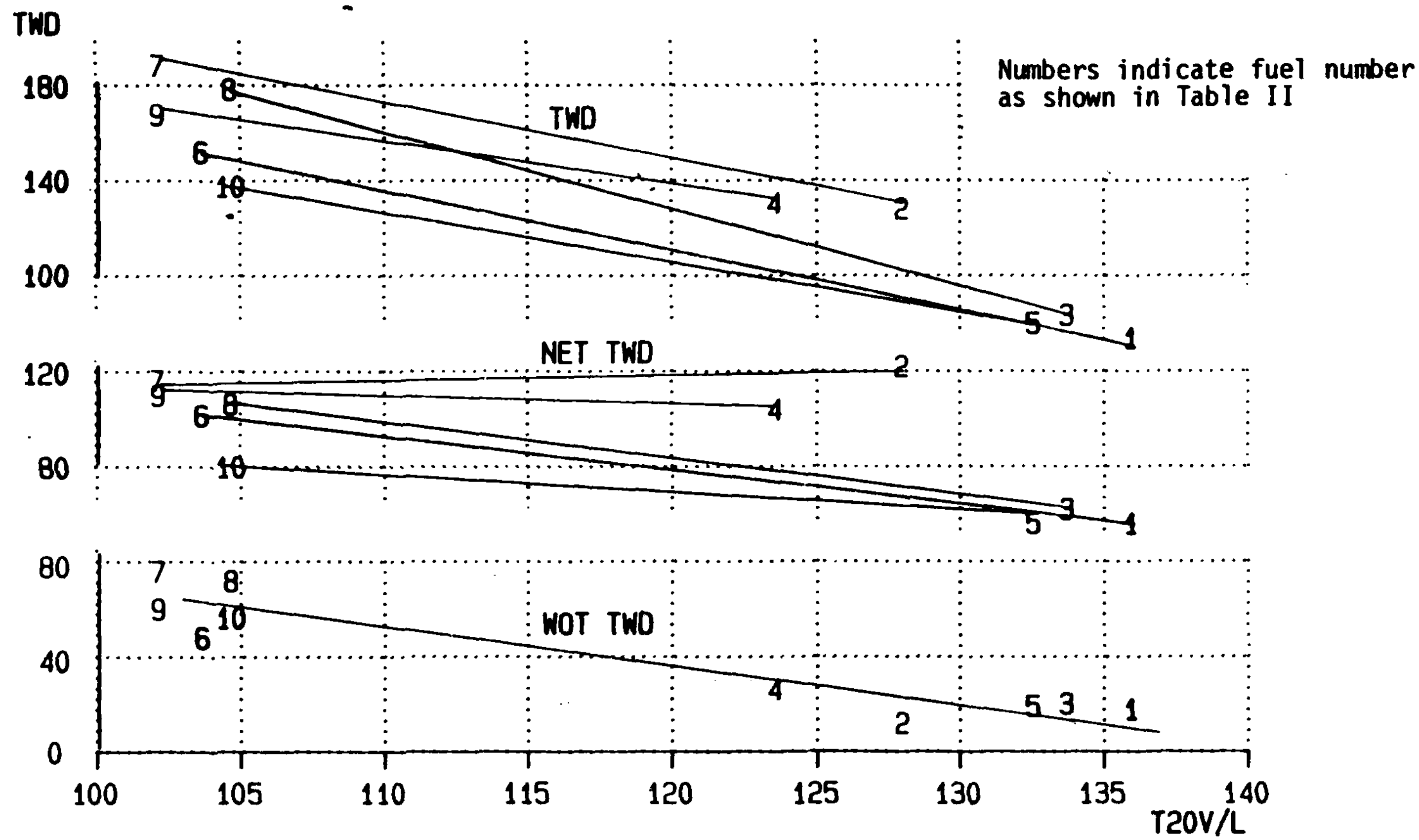
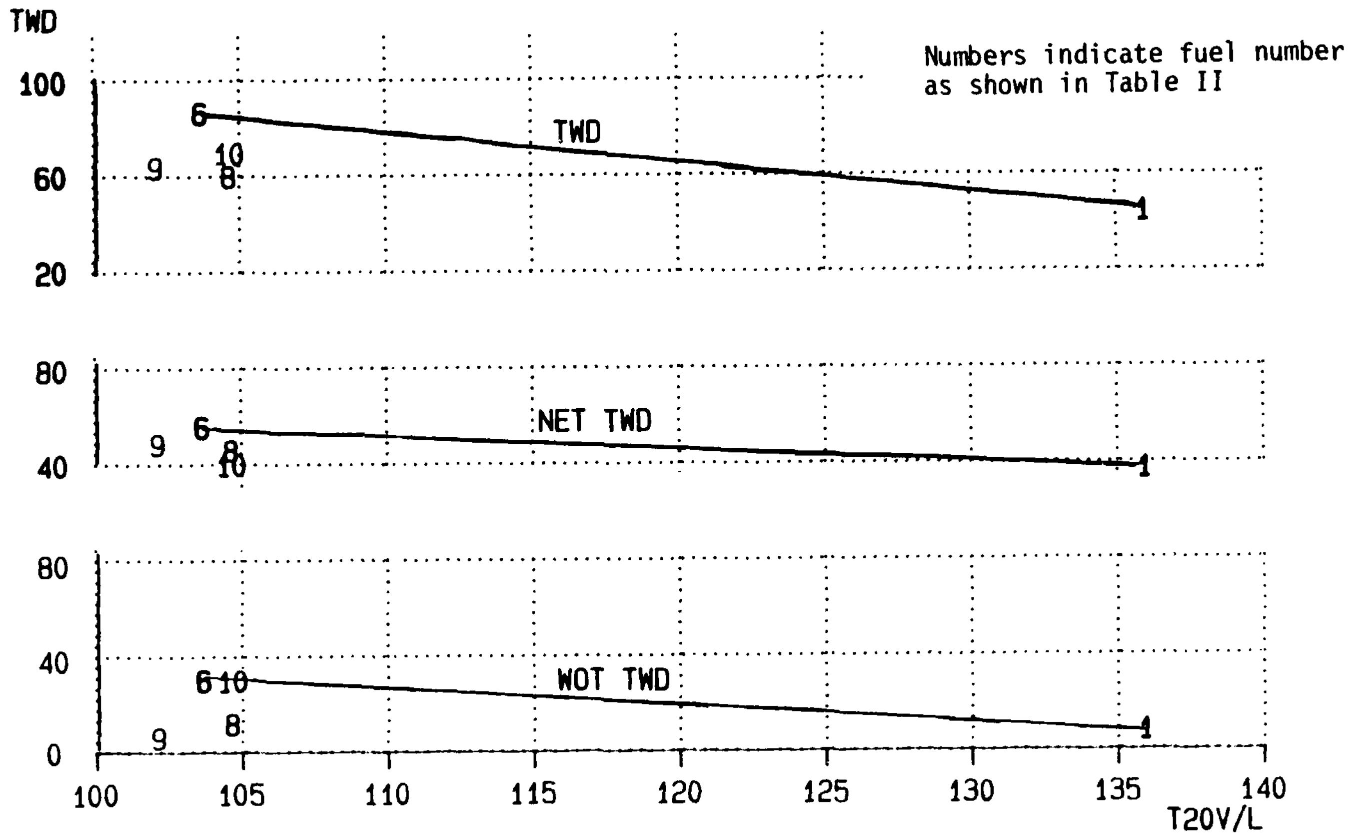


FIGURE 4

TWD SOURCES

FOUR SENSITIVE CARBURETTED CARS AT INTERMEDIATE TEMPERATURE



APPENDIX A

MEMBERSHIP:

1985 CRC VOLATILITY DATA ANALYSIS PANEL
AND
1985 CRC VOLATILITY FUEL ANALYSIS PANEL

MEMBERSHIP OF THE
1985 CRC VOLATILITY DATA ANALYSIS PANEL

Name	Company
E. H. Schanerberger, Leader	Ford Motor Company
D. A. Barker	Shell Development Company
J. C. Ingamells	Chevron Research Company
R. L. Russell	Unocal Corporation
E. D. Steinke	Sun Refining & Marketing Company
L. J. Sumansky	Mobil Research & Development Corp.
C. T. Valade	Chrysler Corporation
P. A. Yaccarino	General Motors Research Laboratories

MEMBERSHIP OF THE
1985 CRC VOLATILITY FUEL ANALYSIS PANEL

Name	Company
P. W. Brigandi	Mobil Research & Development Corp.
T. E. Hayden	Texaco Inc.
J. C. Ingamells	Chevron Research Company
D. Lazzari	Southwest Research Institute
A. T. Leard	Amoco Oil Company
G. Mitsopoulos	General Motors Research Laboratories
G. S. Musser	Exxon Research & Engineering Company
E. H. Schanerberger	Ford Motor Company
E. D. Steinke	Sun Refining & Marketing Company

A P P E N D I X   B

PARTICIPATION:

1985 CRC HIGH- AND INTERMEDIATE-TEMPERATURE DRIVEABILITY PROGRAM

PARTICIPANTS IN THE
1985 CRC HIGH- AND INTERMEDIATE-TEMPERATURE DRIVEABILITY PROGRAM

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Paul Brigandi	Mobil Research & Development Corp.
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Helen Doherty	Sun Refining & Marketing Company
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Gilles Eberhard	Chevron Research Company
Beth Evans	Coordinating Research Council, Inc.
Rick Ewald	General Motors Research Laboratories
Richard Galloway	Celanese Chemical Company
Tom Hayden	Texaco Inc.
John Ingamells	Chevron Research Company
Alan Leard	Amoco Oil Company
Doug McCorkell	Unocal Corporation
Jim Merritt	Amoco Oil Company
Gus Mitsopoulos	General Motors Research Laboratories
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Pete Sarvos	Shell Canada
E. H. Schanerberger, Leader	Ford Motor Company
Jesse Sheets	ARCO Petroleum Products Company
Lou Steinke	Sun Refining & Marketing Company
Jim Thompson	Carter Automotive Group
Chuck Valade	Chrysler Corporation
Andy Vukovic	Shell Canada
Phil Yaccarino	General Motors Research Laboratories

* Participation supported by Exxon Research & Engineering Company.

APPENDIX C

1985 CRC VOLATILITY PROGRAM

COORDINATING RESEARCH COUNCIL
INCORPORATED
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1985 CRC VOLATILITY PROGRAM

(CRC Project No. CM-118-85)

Prepared and Revised by the

CRC Light-Duty Volatility Group

July 1985

PROPOSED CRC LIGHT-DUTY 1985 VOLATILITY PROGRAM

Objective

The objective of this program will be to determine the effects of alcohol (oxygenates) and alcohol types in gasoline over a wide volatility range at the nominal ambient temperatures of 70° and 90°F on hot-start and driveaway driveability and to determine if driveability malfunctions are associated with an over rich condition caused by fuel foaming.

Introduction

Previous CRC hot-weather volatility programs were directed towards establishing a driveability procedure and studying the relationship of volatility parameters to vapor lock and hot-driveability vehicle performance. The effects of oxygenates on vapor lock performance were addressed in a recently conducted CRC program; however, a similar program has not been conducted showing the effects of fuel volatility with hot-start and driveaway vehicle performance. A program of this type will provide information on:

- the effect of oxygenates on hot-start and driveaway vehicle performance at nominal ambient temperatures of 70°F and 90°F.
- the effect of oxygenate type on hot-start and driveaway performance.
- identification of those conditions under which driveability malfunctions occur caused by an over-rich fuel mixture (i.e., precursor to carburetor foaming).

Depending upon the results obtained with this program, a future program may be necessary to define an expression relating fuel volatility, oxygenate effects, and higher oxygenate concentrations.

Scope

A cooperative driveability program will be conducted from September 4 through October 4, 1985 at Failure Analysis Associates Test Track in Phoenix, Arizona. The driveability of selected 1985 model vehicles will be determined at the nominal ambient temperatures of 70° and 90°F using two fuel series and cross-blends of the two fuel series.

Test Fuels

The test fuels will consist of two fuel sets at two volatility levels. Each fuel set will be made up of five test fuels; a hydrocarbon blend, two hydrocarbon-ethanol blends and two hydrocarbon-methanol/TBA blends matched in fuel properties as shown in Table C-I. The higher volatility set will contain one additional fuel blended with ethanol to a higher oxygenate level.

Supplier analyses will include those analyses necessary to provide certification of the fuels to the required specifications. In addition to the supplier analyses, cooperating laboratories will be encouraged to obtain the following lab inspections.

Distillation	D 86
Gravity, API	
T @ V/L 5, 10, 15, 20, 30 and 45	Modified D 2533 (Mercury Method)
FIA (Hydrocarbon Fuel)	
Compositional Analysis	GC
Latent Heat of Vaporization	Calculated and Measured
Net Heating Value	Modified D 240
C/H Analysis	
Reid Vapor Pressure	Dry Method

Test Vehicles

Twelve 1985 model vehicles will be tested. These vehicles will be equipped with automatic transmissions and air conditioning and will be representative of carbureted, throttle-body injected, port injected and turbocharged port injected fuel systems. The vehicles selected are listed in Table C-II.

Instrumentation

The following instrumentation will be provided for the vehicles:

- accelerometer
- stop watch
- manifold vacuum gage
- thermocouple (Type K) for measuring temperature of fuel in tank
- thermocouple (Type K) for measuring underhood fuel temperature
- thermocouple (Type K) located above carburetor bowl vent to sense foaming activity
- temperature read out device

Track Operations and Facilities

A newly paved two-mile oval test track owned by Failure Analysis Associates has been engaged for this program. Vehicle warmup operation may utilize nearby public roads. Specially constructed soak shelters to maximize the sun load but minimize surface wind cooling effects will be installed at an appropriate location immediately adjacent to the track.

Appropriate weather data will be recorded at intervals throughout the testing period.

Program Duration and Manpower Requirements

Program duration is four and one-half weeks. This will provide time for vehicle and site preparation, vehicle and site clean-up, driver training, weekend and weather allowance, and twenty test days. Manpower requirements are for sixteen personnel on site at all times, including four rating crews. Each rating crew is expected to complete five test runs per day (Table C-III).

On-Site Fuel Analysis

On-site fuel analysis will consist of measuring Reid vapor pressure by automated equipment. Distillation and $T_{V/L=20}$ properties of weathered fuel will be obtained from developed relationships of RVP measurements.

Testing Schedule

The experience gained from several previous cooperative programs indicates that inevitably the specific day to day scheduling is greatly influenced by the local conditions of weather and the availability of manpower and vehicles.

Initially, all vehicles will be tested to determine their relative sensitivity to volatility-induced driveability malfunctions. Those vehicles exhibiting significant sensitivity will be scheduled with the appropriate fuels in an attempt to obtain data of maximum usefullness consistent with recognized analysis techniques from the limited resources available in this program. Testing will be done with the two fuel sets and, when appropriate, with cross-blends of the two fuel sets.

Testing Procedure

1. Drain fuel from warmed-up test vehicle.

   (Note: All fuel handling associated with test vehicles will be completed with ignition off.)

2. While fuel is draining from test vehicle, the following data will be recorded:

Date	Test Driver Number
Time	Run Number
Ambient Temperature	Test Fuel Number
Vehicle Number	Number of gallons to be added

3. Refuel test vehicle with designated test fuel (test fuel and number of gallons as recorded in Step 2). Refueling must be completed in time to allow for starting of the Driveaway Procedure within 10 minutes of the beginning of the refueling operation.

4. Air conditioning must be on maximum cooling throughout all vehicle tests.

   Start vehicle by following manufacturers recommended procedure. Record time required to start engine. If engine fails to start after 15 seconds, continue cranking and adjust accelerator pedal until vehicle starts. Record corrective means used for start up.

5. Allow engine to idle in park (manuals in neutral) for 3 minutes. While in idle record:

   - Temperature of fuel in tank
   - Underhood fuel temperature
   - Idle quality

6. Following the 3-minute idle, execute a part-throttle acceleration to access the test track. After entering the test track, continue to accelerate to 55 mph.

7. Maintain 55 mph speed for 15 miles to stabilize engine oil temperature.

8. Return to the fueling area and without draining the fuel tank add additional fuel. Add an amount equal in gallons to the initial fill of the fuel designated for this run in Step 2. Cap the fuel tank, rock car from side-to-side (approximately 30 seconds) to mix fuel in tank. Obtain a fuel tank sample. After sampling is complete, record:

   - Temperature of fuel in tank
   - Underhood fuel temperature

   Maximum time required to complete Step 8 should be 10 minutes.

9. Start vehicle by following manufacturer's recommended procedure. Record time required to start engine. If engine fails to start after 15 seconds, continue cranking and adjust accelerator pedal until vehicle starts. Record corrective means used for start up.

10. Allow engine to idle in park (manuals in neutral) for 30 seconds, then in drive for 30 seconds. Note idle quality. Note temperature above carburetor bowl vent. Followiwng 1 minute idle, execute a part-throttle acceleration, 5 ft/sec^2 (0-10 mph) for distance of 30 to 50 feet to access test track. Stop at entrance to test track for 2 seconds before proceeding. Following the stop, make an immediate 0-55 mph WOT acceleration. Note any driving malfunctions and temperature at carburetor bowl vent.

11. Stop with moderate brake and repeat 0-55 mph WOT acceleration. Stop with moderate brake and again repeat 0-55 mph WOT acceleration. Maintain 55 mph speed for 5 miles. Watch for sudden temperature drop above carburetor bowl vent (~20°). Record temperatures and any driving malfunctions.

12. After completing 5-mile run, bring vehicle to a stop using moderate braking at the first soak shed. Allow engine to idle for 10 minutes in park (manuals in neutral) and record:

    - Temperature of fuel in tank
    - Underhood fuel temperature
    - Idle quality

    Obtain fuel sample.

13. Following shed idle, back vehicle out of soak shed at part throttle 5 ft/sec^2 speed of 0-15 mph for a minimum distance of 30 feet and then stop abruptly. Allow the engine to idle for 15 seconds in drive. Record maneuver malfunctions and idle quality.

14. Execute a part-throttle acceleration 5 ft/sec^2 (0-10 mph) for 30 to 50 feet necessary to access test track. Stop before entering track, using moderate braking, and allow engine to idle in drive for 15 seconds. Record maneuver malfunctions and idle quality.

15. After 15-second idle period, execute the following maneuvers:

    - acceleration from 0-30 mph at part throttle (5 ft/sec^2)
    - maintain 30 mph for 2/10 of a mile
    - accelerate immediately at detent vacuum to 45 mph
    - maintain 45 mph for 2/10 of a mile; then using moderate braking decelerate to 15 mph within 1/10 of a mile

- make an abrupt stop; hesitate for 2 seconds, then make an immediate WOT acceleration to 55 mph; monitor bowl vent temperature
- maintain 55 mph for 2/10 of a mile before a moderate braking to a stop

Record all maneuver malfunctions.

16. After 15-second idle period, execute the following maneuvers in sequence:

    - accelerate at part throttle (5 ft/sec^2) from 0-25 mph, 0-10 mph, 0-25 mph, 0-10 mph, 0-25 mph, 0-10 mph, 0-25 mph and 0-10 mph; stopping using moderate braking and idling for 10 seconds in drive (neutral for manuals) between each acceleration.

    Record all maneuver malfunctions and idle quality.

17. Following the final idle, execute a part throttle (5 ft/sec^2) acceleration from 0-15 mph. Maintain 15 mph for 1/10 of a mile before accelerating at constant 6" vacuum to 55 mph. Complete 10 miles at 55 mph before returning to soak shed. Record all maneuver malfunctions.

18. After returning to soak shed, idle for 2 minutes (manuals in neutral) in drive. Record idle quality.

    Turn off ignition and allow vehicle to soak for 20 minutes. Obtain fuel sample after 15 minutes into soak.

19. At end of soak period, with transmission in park or neutral, start vehicle by following manufacturer's recommended procedure. Record time required to start engine and idle quality. If engine fails to start after 15 seconds, continue cranking and adjust accelerator pedal until vehicle starts. Record corrective means used to start engine.

20. When engine starts, release throttle to idle position. If the engine does not continue to run for one minute, restart engine. If engine stalls 4 times in succession before completing one minute of operation, increase idle speed to keep engine running. Record cumulative starting times and idle quality.

21. Repeat Steps 9 through 11.

NOTE: A driver training session will be conducted at the beginning of the program to minimize driver rating variability.

DEFINITION OF TERMS

HOT START AND DRIVEAWAY INVESTIGATION

Test Run:	Operation of a vehicle throughout a prescribed sequence of operating maneuvers and/or conditions on a single test fuel.
Test Set:	Those test runs necessary for the characterization of a fuel property in a given fuel system.
Fuel Foaming:	A rich condition resulting from foam build-up at a point in the vehicle fuel system prior to combustion. The opposite of vapor lock.
Vehicle Malfunction:	The inability of a vehicle to perform a prescribed maneuver and/or test condition smoothly.
Maneuver:	A specified single vehicle operation that constitutes a segment of the driveability driving schedule.
Start Time:	The cumulative total of seconds necessary to start the engine and have it run for a prescribed idle period prior to transmission engagement.
Stall:	The engine stopping with ignition on during any segment of the driveability driving schedule and/or test condition. There are three types of stalls - accel, decel, and idle.
Wide-Open Throttle (WOT) Acceleration:	The flooring of the accelerator pedal to accelerate through the gears from a prescribed starting speed.
Part-Throttle (PT) Acceleration:	An acceleration made at a fixed throttle position, or rate of acceleration, less than WOT.
Hesitation:	A temporary lack of initial response in acceleration rate.
Stumble:	A short, sharp reduction in acceleration rate.
Surge:	A continued condition of short fluctuations in power.
Backfire:	An explosion in the induction or exhaust system.

DEMERIT CALCULATION SYSTEM

A numerical value for driveability during the CRC test is obtained by assigning demerits to operating malfunctions as shown in Table C-IV. Depending upon the type of malfunction, demerits are assigned in various ways. Demerits for poor starting are obtained by subtracting two seconds from the measured starting time. The number of stalls which occur during idle as well as during driving maneuvers are counted separately and assigned demerits as shown in Table IV. The multiplying factors of 8 and 32 for idle and maneuvering stalls, respectively, account for the fact that stalls are very undesirable, especially during car maneuvers.

Other malfunctions, such as hesitation, stumble, surge, idle roughness, and backfire, are rated subjectively by the driver on a scale of trace, moderate, or heavy. For these malfunctions, a certain number of demerits is assigned to each of the subjective ratings. However, since all malfunctions are not of equal importance, the demerits are multiplied by the weighting factors shown in Table IV to yield weighted demerits.

Finally, weighted demerits, demerits for stalls, and demerits for poor starting are summed to obtain total weighted demerits (TWD), which are used as an indication of driveability during the test. As driveability deteriorates, TWD increases.

TABLE C-I

TEST FUEL SPECIFICATIONS

Fuel	% O_2*	$T_{V/L=20}$ (°F)	T_{10} (°F)	T_{30} (°F)	T_{50} (°F)	T_{90} (°F)
1	0	E**	A**	B**	C**	D**
2	3.5M	E±3	A±5	B±5	C±5	D±10
3	3.5M	E±3	Fuel 1 with butane adjusted			
4	3.5E	E±3	A±5	B±5	C±5	D±10
5	3.5E	E±3	Fuel 1 with butane adjusted			
6	0	F**	G**	H**	I**	J**
7	3.5M	F±3	G±5	H±5	I±5	J±10
8	3.5M	F±3	Fuel 6 with butane adjusted			
9	3.5E	F±3	G±5	H±5	I±5	J±10
10	3.5E	F±3	Fuel 6 with butane adjusted			
11	5.0E	Add 1.5% Ethanol to Fuel 10				

* M = Methanol:TBA blend of 1:1 ratio; E = Ethanol
** Values for A through J are targets for Fuels 1 and 6 as follow:

A = no spec set	G = no spec set
B = no spec set	H = no spec set
C = 225 ± 5	F = 105 ± 3
D = 320 ± 10	I = 205 ± 5
E = 133 ± 3	J = 320 ± 10

NOTE:

Fuels 3 and 5 to be Fuel 1 with only butane adjusted to attain $T_{V/L=20}$ specification (i.e., Fuel 3 is not to be identical to Fuel 2).

Fuels 8 and 10 to be Fuel 6 with only butane adjusted to attain $T_{V/L=20}$ specification (i.e., Fuel 8 is not to be identical to Fuel 7).

ALL FUELS:

$\frac{RON + MON}{2}$	= 88 MIN
% Aromatics	= 25-35
Lead Content	= 0.05 g/gal max
Corrosion Inhibitor	= 3 PTB
Antioxidant	= 5 PTB

TABLE C-II

TEST FLEET

Manufacturer	Model	Displacement	Fuel System
American Motors	Alliance	1.4 or 1.7	Throttle-body injected
Chrysler	L or K body	2.2	Carburetted
Chrysler	-	2.2	Port-injected turbo
Ford	Escort	1.9	Carburetted
Ford	Escort	1.9	Port-injected EFI
Ford	Ford LTD	3.8	Throttle-body injected
General Motors	Buick	3.0	Carburetted
General Motors	Chev. X Body	2.8	Carburetted
General Motors	Firebird	5.0	Carburetted
General Motors	Pontiac	2.5	Throttle-body injected
General Motors	Buick	3.8	Port-injected
Toyota		2.8	Port-injected
Alternate Vehicles			
Nissan	Sentra	1.5	Carburetted
Ford	Tempo	2.3	Throttle-body injected

NOTE: Vehicle selection, should any substitution be necessary, will be by fuel system per manufacturer.

TABLE C-III

PROGRAM DURATION AND MANPOWER REQUIREMENTS

Program Duration	Days Required
Preparation and Driver Selection	3
Testing	20
Weather Allowance (Weekends)	8
TOTAL	31

Manpower Requirements	No. of People
Raters	4
Observers	4
Warm-up and Preparation	4
Data Handling and Project Coordinator	1
Asst. Data Handling and Track Operations	2
Fuel Analysis	1
TOTAL	16

TABLE C-IV

METHOD FOR CALCULATING TOTAL WEIGHTED DEMERITS (TWD)

Demerits for Poor Starting:

Demerits = Starting Time(s) - 2

Demerits for Stalls:

Demerits = (No. of Idle Stalls) x 8 + (No. of Maneuvering Stalls) x 32

Demerits for Malfunctions Rated Subjectively:

Demerits for Subjective Ratings

Trace	=	1
Moderate	=	2
Heavy	=	4

Weighting Factors for Each Malfunction

Idle Roughness	=	1
Surge	=	4
Backfire, Stumble, Hesitation	=	6

Weighted Demerits = Demerits x Weighting Factor

Calculation:

Total Weighted Demerits = *Weighted Demerits + Demerits for Stalls +*
Demerits for Poor Starting

Note: When more than one malfunction occurs in a driving maneuver, only the malfunction giving the highest weighted demerits is counted.

1985 CRC HOT WEATHER DRIVEABILITY RATING SHEET

Run No.______ Vehicle No.______ Initial Fill: Fuel______ Gal______ Fuel______ Gal______ Refuel Fill: Fuel______ Gal______ Fuel______ Gal______

Driver No.______ Date__________ Time______ Temp.______ Wind______ Bar.Pres.______ Cloud Cover______

MODE	Init. Start Sec.	Restart		Idle		Driving					Temperature			Fuel Smpl No.	TWD
		Sec.	No.	Rgh	Stall	Hes.	Stum	Surge	Back-Fire	Stall	Tank	Under-hood	Carb.		
Initial Start															
Idle 3 Min. Park															
Warm Up - 55 mph 15 Miles															
Refuel/Obtain Sample Refuel Start															
Idle 30 Sec. Park															
Idle 30 sec. Drive															
PT Accel to Test Track 5 ft/sec^2 - 0-10 mph															
2 Sec. Delay at Track 0-55 mph WOT															
Moderate Stop 0-55 mph WOT															
Moderate Stop 0-55 mph WOT															
Warm Up - 55 mph 5 Miles															
Moderate Stop at Soak Shed Idle 10 Min. - Park															
Back Out - 0-15 mph - 30 ft 5 ft/sec^2 - Abrupt Stop															
Idle 15 Sec. Drive															
PT Accel to Test Track 5 ft/sec^2 - 0-10 mph															
Moderate Stop Idle 15 Sec. Drive															
PT Accel - 5 ft/sec^2 0-30 mph															
30 mph for 2/10 Mile															
30-45 mph at Detent Vacuum															
45 mph for 2/10 Mile															
Moderate Brake Decel to 15 mph w/i 1/10 Mile															
Abrupt Stop 2 Sec. Delay															
0-55 mph WOT															
55 mph for 2/10 Mile															
Moderate Stop Idle 15 Sec.															
PT Accel - 5 ft/sec^2 0-25 mph															
Moderate Stop Idle 10 Sec. Drive															
PT Accel - 5 ft/sec^2 0-10 mph															
Moderate Stop Idle 10 Sec. Drive															
PT Accel - 5 ft/sec^2 0-25 mph															

REMARKS:

1985 CRC HOT WEATHER DRIVEABILITY RATING SHEET

Run No.______ Vehicle No.______ Initial Fill: Fuel______ Gal______ Fuel______ Gal______ Refuel Fill: Fuel______ Gal______ Fuel______ Gal______

Driver No.______ Date__________ Time______ Temp.______ Wind______ Bar.Pres.______ Cloud Cover______

MODE	Init. Start Sec.	Restart		Idle		Driving					Temperature			Fuel Smpl No.	TWD
		Sec.	No.	Rgh	Stall	Hes.	Stum	Surge	Back-Fire	Stall	Tank	Under-hood	Carb.		
Moderate Stop Idle 10 Sec. Drive															
PT Accel - 5 ft/sec² 0-10 mph															
Moderate Stop Idle 10 Sec. Drive															
PT Accel - 5 ft/sec² 0-25 mph															
Moderate Stop Idle 10 Sec. Drive															
PT Accel - 5 ft/sec² 0-10 mph															
Moderate Stop Idle 10 Sec. Drive															
PT Accel - 5 ft/sec² 0-25 mph															
Moderate Stop Idle 10 Sec. Drive															
PT Accel - 5 ft/sec² 0-10 mph															
Moderate Stop Idle 10 Sec. Drive															
PT Accel - 5 ft/sec² 0-15 mph															
15 mph for 1/10 Mile - Accel to 55 mph at Cons. 6" Vacuum															
Warm Up - 55 mph 10 Miles															
Return to Soak Shed Idle 2 Min. Drive															
Ignition Off Soak - 20 Min. Fuel Sample 15 Min. into Soak															
Start															
Idle 1 Min. Park															
Back Out - 0-15 mph - 30 ft 5 ft/sec² - Abrupt Stop															
Idle 15 Sec. Drive															
PT Accel to Test Track 5 ft/sec² - 0-10 mph															
Moderate Stop Idle 15 Sec. Drive															
PT Accel - 5 ft/sec² 0-30 mph															
30 mph for 2/10 Mile															
30-45 mph at Detent Vacuum															
45 mph for 2/10 Mile															
Moderate Brake Decel to 15 mph w/i 1/10 Mile															
Abrupt Stop 2 Sec. Delay															
0-55 mph WOT															
55 mph for 2/10 Mile															
Moderate Stop Idle 15 Sec.															

REMARKS:

APPENDIX D

INDIVIDUAL LABORATORY FUEL PROPERTY DATA

TABLE D-I

PARTICIPANT LABORATORY TEST FUEL ANALYSES - TEST FUEL #1

Laboratory:	Drum Retain Samples 1	2	3	4	5	6A	7	Spec.	On-Site Drum Samples 8A	8B	6B
Spec. Gravity @ 60/60°F	.756	.754	.752	.754	-	.750	.753				
Distillation, °F											
@ IBP	96	86	82	90	94	91	81		82		
@ 5% Evap.	118	110	106	114	109	109	102				
@ 10% Evap.	133	128	129	132	123	131	122	128±5	124		
@ 15% Evap.	-	145	149	-	140	147	-				
@ 20% Evap.	165	163	165	163	157	163	155		156		
@ 25% Evap.	-	179	179	-	173	-	-				
@ 30% Evap.	193	192	190	192	188	191	186	190±5	184		
@ 35% Evap.	-	203	200	-	199	-	-				
@ 40% Evap.	212	212	209	212	209	211	206				
@ 45% Evap.	-	220	217	-	218	-	-				
@ 50% Evap.	227	227	225	226	226	226	222	226±5	222		
@ 55% Evap.	-	234	-	-	232	-	-				
@ 60% Evap.	241	241	239	241	239	242	235				
@ 65% Evap.	-	248	-	-	246	-	-				
@ 70% Evap.	256	256	254	257	253	258	251				
@ 75% Evap.	-	267	-	-	265	-	-				
@ 80% Evap.	283	282	277	284	278	283	277				
@ 85% Evap.	-	305	-	-	302	-	-				
@ 90% Evap.	339	334	330	341	334	340	331	336±10	350		
@ 95% Evap.	383	380	-	387	381	382	372				
End Point	428	434	418	431	421	443	424		419		
RVP, psi, @ 100°F	10.4	10.2	9.5	9.9	10.2	10.3	10.1		10.5		10.4
$T_{V/L=20}$, °F (Hg)	136.0	137.8	137.0	-	134.5	-	134.8	136±3			
$T_{V/L=20}$, °F (Bomb)										146	
vol % Alcohol - MeOH	0	0	0	0	-	0	0	0			
- EtOH	0	0	0	0	-	0	0	0			
- TBA	0	0	0	0	-	0	0	0			

NOTE: A and B designate same company at different localities.

TABLE D-II

PARTICIPANT LABORATORY TEST FUEL ANALYSES - TEST FUEL #2

	Drum Retain Samples								On-Site Drum Samples		
Laboratory:	1	2	3	4	5	6A	7	Spec.	8A	8B	6B
Spec. Gravity @ 60/60°F	.748	.748	.745	.749	-	.745	.749				
Distillation, °F											
@ IBP	100	101	98	103	97	101	93		97		
@ 5% Evap.	121	118	115	123	119	110	116				
@ 10% Evap.	130	130	127	128	129	127	128	128 ± 5	128		
@ 15% Evap.	-	139	137	-	138	138	-				
@ 20% Evap.	151	152	149	153	149	150	150		146		
@ 25% Evap.	-	172	163	-	168	-	-				
@ 30% Evap.	191	191	183	190	190	187	187	190 ± 5	179		
@ 35% Evap.	-	207	203	-	205	-	-				
@ 40% Evap.	217	218	214	216	216	215	214				
@ 45% Evap.	-	227	221	-	225	-	-				
@ 50% Evap.	231	232	228	232	232	231	229	226 ± 5	228		
@ 55% Evap.	-	237	-	-	236	-	-				
@ 60% Evap.	241	242	240	241	240	241	238				
@ 65% Evap.	-	248	-	-	247	-	-				
@ 70% Evap.	252	255	256	253	254	253	252				
@ 75% Evap.	-	262	-	-	264	-	-				
@ 80% Evap.	280	280	280	284	290	285	277				
@ 85% Evap.	-	304	-	-	305	-	-				
@ 90% Evap.	333	329	328	329	329	333	328	336 ± 10	330		
@ 95% Evap.	359	356	-	372	359	373	356				
End Point	460	445	420	440	391	458	436		374		
RVP, psi, @ 100°F	9.8	10.0	9.7	9.6	9.6	10.2	9.7		10.0		10.1
$T_{V/L=20}$, °F (Hg)	127.0	128.2	127.0	-	128.0	-	129.9	136 ± 3			
$T_{V/L=20}$, °F (Bomb)										128	
vol % Alcohol - MeOH	3.47	4.70	4.00	5.10	-	4.16	3.80				
- EtOH	-	-	-	-	-	-	-				
- TBA	4.94	5.10	4.00	5.80	-	4.50	4.40				

NOTE: A and B designate same company at different localities.

TABLE D-III

PARTICIPANT LABORATORY TEST FUEL ANALYSES - TEST FUEL #3

Laboratory:	Drum Retain Samples 1	2	3	4	5	6A	7	Spec.	On-Site Drum Samples 8A	8B	6B
Spec. Gravity @ 60/60°F	.766	.766	.763	.767	-	.769	.766				
Distillation, °F											
@ IBP	107	108	98	111	107	105	99		99		
@ 5% Evap.	127	124	120	126	126	121	123				
@ 10% Evap.	133	131	131	134	133	131	131		129		
@ 15% Evap.	-	138	139	-	139	139	-				
@ 20% Evap.	147	146	145	146	147	146	145		145		
@ 25% Evap.	-	157	154	-	157	-	-				
@ 30% Evap.	172	171	165	172	171	170	169		167		
@ 35% Evap.	-	183	181	-	183	-	-				
@ 40% Evap.	191	191	191	194	192	191	191				
@ 45% Evap.	-	199	199	-	201	-	-				
@ 50% Evap.	207	207	205	206	208	207	206		204		
@ 55% Evap.	-	214	-	-	215	-	-				
@ 60% Evap.	220	221	215	220	221	220	220				
@ 65% Evap.	-	226	-	-	226	-	-				
@ 70% Evap.	231	231	226	235	232	230	230				
@ 75% Evap.	-	236	-	-	237	-	-				
@ 80% Evap.	243	244	241	241	244	242	242				
@ 85% Evap.	-	254	-	-	255	-	-				
@ 90% Evap.	278	279	273	290	282	285	277		278		
@ 95% Evap.	350	345	-	355	359	347	348				
End Point	417	411	408	413	408	413	407		394		
RVP, psi, @ 100°F	8.3	8.3	8.6	8.1	8.0	8.3	8.0		8.4		8.3
$T_{V/L=20}$, °F (Hg)	131.0	134.0	134.0	-	134.0	-	135.9	136$\pm$3			
$T_{V/L=20}$, °F (Bomb)										150.8	
vol % Alcohol - MeOH	4.44	4.40	4.00	4.20	-	4.38	4.00				
- EtOH	-	-	-	-	-	-	-				
- TBA	5.05	4.80	5.00	4.90	-	4.66	4.60				

NOTE: A and B designate same company at different localities.

TABLE D-IV

PARTICIPANT LABORATORY TEST FUEL ANALYSES - TEST FUEL #4

	Drum Retain Samples								On-Site Drum Samples		
Laboratory:	1	2	3	4	5	6A	7	Spec.	8A	8B	6B
Spec. Gravity @ 60/60°F	.808	.807	.806	.807	-	.810	.809				
Distillation, °F											
@ IBP	92	85	90	94	89	91	90		101		
@ 5% Evap.	-	-	104	124	-	-	-				
@ 10% Evap.	131	126	116	147	129	136	134	128±5	150		
@ 15% Evap.	-	148	130	-	149	160	-				
@ 20% Evap.	163	162	145	166	162	164	161				
@ 25% Evap.	-	169	163	-	171	-	-				
@ 30% Evap.	188	182	185	206	185	191	189	190±5	194		
@ 35% Evap.	-	213	210	-	216	-	-				
@ 40% Evap.	229	229	225	236	231	228	224				
@ 45% Evap.	-	232	232	-	236	-	-				
@ 50% Evap.	237	234	237	243	239	239	237	226±5	240		
@ 55% Evap.	-	241	-	-	243	-	-				
@ 60% Evap.	245	246	245	246	247	248	246				
@ 65% Evap.	-	252	-	-	253	-	-				
@ 70% Evap.	258	257	259	268	260	260	260				
@ 75% Evap.	-	268	-	-	271	-	-				
@ 80% Evap.	285	282	286	302	286	287	286				
@ 85% Evap.	-	302	-	-	308	-	-				
@ 90% Evap.	323	323	326	334	326	332	323	336±10	314		
@ 95% Evap.	-	347	-	363	338	359	339				
End Point	416	387	394	397	386	412	413		362		
RVP, psi @ 100°F	12.6	12.7	12.6	12.7	12.6	12.8	12.3		13.0		13.0
$T_{V/L=20}$, °F (Hg)	124.0	124.0	122.0	-	123.0	-	124.4	136±3			
$T_{V/L=20}$, °F (Bomb)										140	
vol % Alcohol - MeOH	-	-	-	-	-	-	-				
- EtOH	10.0	9.1	9.0	9.6	-	8.30	8.80				
- TBA	-	-	-	-	-	-	-				

NOTE: A and B designate same company at different localities.

TABLE D-V

PARTICIPANT LABORATORY TEST FUEL ANALYSES - TEST FUEL #5

Laboratory:	Drum Retain Samples 1	2	3	4	5	6A	7	Spec.	On-Site Drum Samples 8A	8B	6B
Spec. Gravity @ 60/60°F	.756	.756	.754	.756	-	.753	.756				
Distillation, °F											
@ IBP	93	110	96	102	99	95	88		100		
@ 5% Evap.	119	115	119	124	121	118	114				
@ 10% Evap.	129	133	131	134	131	132	129		136		
@ 15% Evap.	-	140	139	-	138	140	-				
@ 20% Evap.	143	145	145	144	144	146	144		146		
@ 25% Evap.	-	150	149	-	149	-	-				
@ 30% Evap.	151	154	152	154	153	153	152		154		
@ 35% Evap.	-	159	159	-	157	-	-				
@ 40% Evap.	166	174	168	178	169	172	168				
@ 45% Evap.	-	200	183	-	198	-	-				
@ 50% Evap.	211	215	207	211	213	211	209		193		
@ 55% Evap.	-	222	220	-	222	-	-				
@ 60% Evap.	225	227	233	233	229	230	227				
@ 65% Evap.	-	235	-	-	235	-	-				
@ 70% Evap.	239	244	244	242	244	246	241				
@ 75% Evap.	-	256	256	-	254	-	-				
@ 80% Evap.	263	269	268	272	266	270	267				
@ 85% Evap.	-	295	-	-	295	-	-				
@ 90% Evap.	331	327	334	343	337	338	331		336		
@ 95% Evap.	370	375	-	385	380	383	373				
End Point	419	422	420	424	421	422	418		407		
RVP, psi, @ 100°F	9.2	9.2	9.0	8.8	8.8	9.4	8.8		9.4		9.2
$T_{V/L=20}$, °F (Hg)	131.0	132.6	132.0	-	132.5	-	134.2	136±3			
$T_{V/L=20}$, °F (Bomb)										140	
vol % Alcohol - MeOH	-	-	-	-	-	-	-				
- EtOH	10.0	9.7	9.7	9.5	-	8.50	8.70				
- TBA	-	-	-	-	-	-	-				

NOTE: A and B designate same company at different localities.

TABLE D-VI

PARTICIPANT LABORATORY TEST FUEL ANALYSES - TEST FUEL #6

Laboratory:	Drum Retain Samples 1	2	3	4	5	6A	7	Spec.	On-Site Drum Samples 8A	8B	6B
Spec. Gravity @ 60/60°F	.740	.737	.730	.732	-	.733	.735				
Distillation, °F											
@ IBP	76	78	74	80	75	72	76		77		
@ 5% Evap.	-	-	82	95	82	-	-				
@ 10% Evap.	95	89	92	108	93	90	94	94±5	114		
@ 15% Evap.	-	100	103	-	103	108	-				
@ 20% Evap.	121	112	118	133	115	118	120				
@ 25% Evap.	-	129	137	-	133	-	-				
@ 30% Evap.	157	150	154	169	154	155	153	156±5	144		
@ 35% Evap.	-	170	172	-	174	-	-				
@ 40% Evap.	190	186	187	199	189	187	186				
@ 45% Evap.	-	198	199	-	201	-	-				
@ 50% Evap.	211	208	209	215	211	207	208	210±5	210		
@ 55% Evap.	-	215	-	-	219	-	-				
@ 60% Evap.	226	222	224	231	227	221	224				
@ 65% Evap.	-	229	-	-	234	-	-				
@ 70% Evap.	242	236	241	251	242	239	240				
@ 75% Evap.	-	247	-	-	252	-	-				
@ 80% Evap.	265	262	263	280	265	269	267				
@ 85% Evap.	-	289	-	-	293	-	-				
@ 90% Evap.	339	328	328	360	331	335	328	336±10	348		
@ 95% Evap.	-	372	-	419	382	390	370				
End Point	425	423	418	430	423	430	424		415		
RVP, psi @ 100°F	15.8	15.1	15.8	15.5	15.8	16.3	15.6		15.9		16.1
$T_{V/L=20}$, °F (Hg)	102.0	105.0	101.0	-	106.0	-	104.7	103.7±3			
$T_{V/L=20}$, °F (Bomb)										110.2	
vol % Alcohol - MeOH	0	0	0	0	-	0	0				
- EtOH	0	0	0	0	-	0	0				
- TBA	0	0	0	0	-	0	0				

NOTE: A and B designate same company at different localities.

TABLE D-VII

PARTICIPANT LABORATORY TEST FUEL ANALYSES - TEST FUEL #7

Laboratory:	Drum Retain Samples 1	2	3	4	5	6A	7	Spec.	On-Site Drum Samples 8A	8B	6B
Spec. Gravity @ 60/60°F	.754	.756	.750	.754	-	.751	.753				
Distillation, °F											
@ IBP	78	84	78	84	84	76	78		82		
@ 5% Evap.	-	89	91	101	-	-	-				
@ 10% Evap.	99	98	101	112	99	97	101	94±5	109		
@ 15% Evap.	-	107	111	-	109	111	-				
@ 20% Evap.	122	116	120	131	120	122	122				
@ 25% Evap.	-	125	131	-	130	-	-				
@ 30% Evap.	145	138	144	161	142	145	146	156±5	144		
@ 35% Evap.	-	157	162	-	161	-	-				
@ 40% Evap.	184	175	179	196	180	177	178				
@ 45% Evap.	-	192	194	-	198	-	-				
@ 50% Evap.	213	207	208	223	212	211	210	210±5	212		
@ 55% Evap.	-	219	-	-	224	-	-				
@ 60% Evap.	236	230	233	244	235	235	235				
@ 65% Evap.	-	238	-	-	245	-	-				
@ 70% Evap.	255	249	256	266	254	253	255				
@ 75% Evap.	-	261	-	-	266	-	-				
@ 80% Evap.	281	274	281	301	281	283	282				
@ 85% Evap.	-	297	-	-	301	-	-				
@ 90% Evap.	330	322	332	380	326	336	326	336±10	340		
@ 95% Evap.	-	363	-	426	373	378	353				
End Point	428	424	414	430	423	432	423		413		
RVP, psi, @ 100°F	15.8	15.9	16.0	15.8	15.7	16.6	15.8		17.3		16.7
$T_{V/L=20}$, °F (Hg)	102.0	101.7	102.0	-	101.5	-	104.3	103.7±3			
$T_{V/L=20}$, °F (Bomb)										110.4	
vol % Alcohol - MeOH	4.59	5.30	4.00	4.50	-	3.50	3.80				
- EtOH	-	-	-	-	-	-	-				
- TBA	5.13	6.00	4.00	5.40	-	3.90	4.40				

NOTE: A and B designate same company at different localities.

TABLE D-VIII

PARTICIPANT LABORATORY TEST FUEL ANALYSES - TEST FUEL #8

Laboratory:	Drum Retain Samples 1	2	3	4	5	6A	7	Spec.	On-Site Drum Samples 8A	8B	6B
Spec. Gravity @ 60/60°F	.744	.748	.742	.744	-	.752	.744				
Distillation, °F											
@ IBP	82	86	78	85	85	79	80		80		
@ 5% Evap.	95	89	86	98	93	83	86				
@ 10% Evap.	107	101	95	110	103	101	103		107		
@ 15% Evap.	-	111	107	-	112	113	-				
@ 20% Evap.	124	120	120	123	121	123	121		124		
@ 25% Evap.	-	129	134	-	129	-	-				
@ 30% Evap.	143	139	146	144	139	141	140		144		
@ 35% Evap.	-	152	157	-	150	-	-				
@ 40% Evap.	173	169	169	173	166	167	167				
@ 45% Evap.	-	185	182	-	183	-	-				
@ 50% Evap.	200	198	197	201	196	196	195		200		
@ 55% Evap.	-	211	-	-	209	-	-				
@ 60% Evap.	223	221	226	224	221	219	218				
@ 65% Evap.	-	230	-	-	231	-	-				
@ 70% Evap.	240	239	240	241	240	238	238				
@ 75% Evap.	-	248	-	-	249	-	-				
@ 80% Evap.	262	262	259	266	262	263	264				
@ 85% Evap.	-	284	-	-	286	-	-				
@ 90% Evap.	335	316	310	338	329	331	326		350		
@ 95% Evap.	381	367	-	394	380	380	363				
End Point	421	418	414	426	419	427	420		402		
RVP, psi, @ 100°F	15.0	14.9	14.6	15.0	15.3	15.5	14.7		15.5		15.4
$T_{V/L=20}$, °F (Hg)	104.0	105.4	105.0	-	103.0	-	106.2	103.7±3			
$T_{V/L=20}$, °F (Bomb)										113.2	
vol % Alcohol - MeOH	4.89	5.10	4.00	5.20	-	4.49	4.10				
- EtOH	-	-	-	-	-	-	-				
- TBA	4.84	5.30	4.00	5.80	-	4.63	4.70				

NOTE: A and B designate same company at different localities.

TABLE D-IX

PARTICIPANT LABORATORY TEST FUEL ANALYSES - TEST FUEL #9

Laboratory:	Drum Retain Samples 1	2	3	4	5	6A	7	Spec.	On-Site Drum Samples 8A	8B	6B
Spec. Gravity @ 60/60°F	.770	.760	.755	.758	-	.754	.758				
Distillation, °F											
@ IBP	76	83	76	80	79	77	79		77		
@ 5% Evap.	-	-	87	96	-	-	-				
@ 10% Evap.	95	98	98	117	95	99	98	1±5	108		
@ 15% Evap.	-	109	110	-	108	113	-				
@ 20% Evap.	121	121	124	135	121	124	124				
@ 25% Evap.	-	137	138	-	136	-	-				
@ 30% Evap.	157	148	148	155	149	148	148	156±5	150		
@ 35% Evap.	-	157	155	-	157	-	-				
@ 40% Evap.	190	161	161	191	162	169	168				
@ 45% Evap.	-	173	170	-	174	-	-				
@ 50% Evap.	210	217	181	231	217	213	206	210±5	222		
@ 55% Evap.	-	234	-	-	237	-	-				
@ 60% Evap.	225	244	225	261	248	247	246				
@ 65% Evap.	-	256	-	-	257	-	-				
@ 70% Evap.	241	268	294	282	267	266	267				
@ 75% Evap.	-	281	-	-	280	-	-				
@ 80% Evap.	264	294	316	307	294	293	293				
@ 85% Evap.	-	310	-	-	310	-	-				
@ 90% Evap.	326	330	328	371	329	337	335	336±10	343		
@ 95% Evap.	-	370	-	416	357	403	371				
End Point	427	424	416	428	418	424	399		409		
RVP, psi, @ 100°F	16.1	16.0	16.2	15.8	16.3	16.8	16.0		17.2		16.8
$T_{V/L=20}$, °F (Hg)	103.0	102.8	102.0	-	100.5	-	103.0	103.7±3			
$T_{V/L=20}$, °F (Bomb)										111.0	
vol % Alcohol - MeOH	-	-	-	-	-	-	-				
- EtOH	10.2	10.5	8.0	9.9	-	8.33	8.80				
- TBA	-	-	-	-	-	-	-				

NOTE: A and B designate same company at different localities.

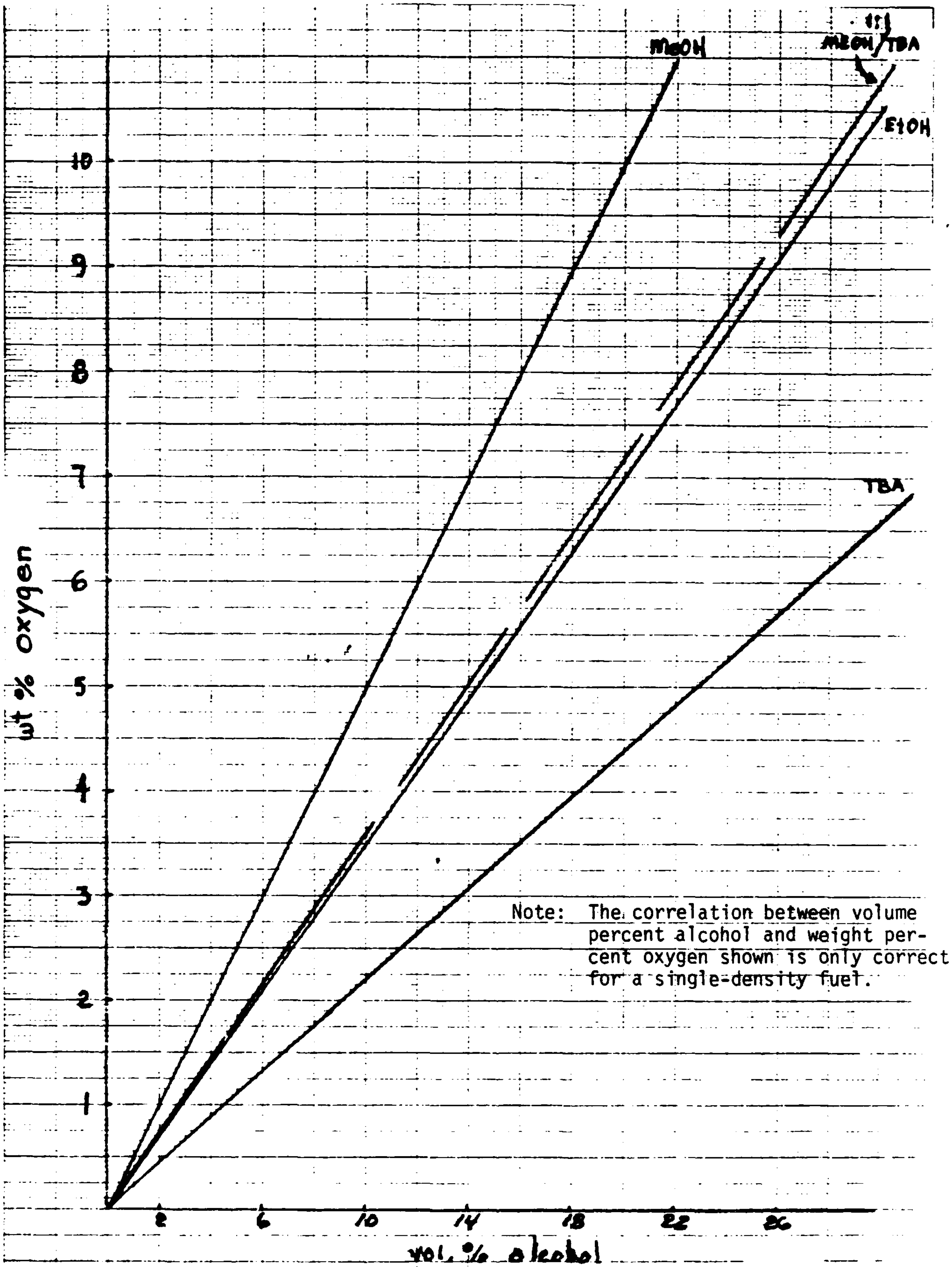
TABLE D-X

PARTICIPANT LABORATORY TEST FUEL ANALYSES - TEST FUEL #10

	Drum Retain Samples								On-Site Drum Samples		
Laboratory:	1	2	3	4	5	6A	7	Spec.	8A	8B	6B
Spec. Gravity @ 60/60°F	.741	.746	.737	.741	-	.735	.740				
Distillation, °F											
@ IBP	84	89	74	90	84	82	78		78		
@ 5% Evap.	-	93	87	106	88	98	87				
@ 10% Evap.	103	101	99	116	101	100	107		106		
@ 15% Evap.	-	111	112	-	112	117	-				
@ 20% Evap.	125	123	126	136	123	129	126		126		
@ 25% Evap.	-	134	136	-	134	-	-				
@ 30% Evap.	143	143	145	146	144	145	142		144		
@ 35% Evap.	-	150	152	-	151	-	-				
@ 40% Evap.	154	155	159	160	155	156	153				
@ 45% Evap.	-	160	171	-	160	-	-				
@ 50% Evap.	181	180	186	196	182	181	185		182		
@ 55% Evap.	-	209	-	-	209	-	-				
@ 60% Evap.	220	220	220	229	221	220	217				
@ 65% Evap.	-	229	-	-	230	-	-				
@ 70% Evap.	235	236	238	240	238	241	237				
@ 75% Evap.	-	245	-	-	248	-	-				
@ 80% Evap.	259	261	253	267	260	266	261				
@ 85% Evap.	-	282	-	-	285	-	-				
@ 90% Evap.	325	323	324	344	330	322	325		343		
@ 95% Evap.	-	368	-	388	376	371	375				
End Point	420	420	412	422	420	428	420		411		
RVP, psi, @ 100°F	15.3	15.1	15.4	14.9	14.9	15.7	14.9		15.5		15.6
$T_{V/L=20}$, °F (Hg)	103.0	105.5	102.0	-	105.5	-	106.7	103.7±3			
$T_{V/L=20}$, °F (Bomb)										112.8	
vol % Alcohol - MeOH	-	-	-	-	-	-	-				
- EtOH	10.3	12.6	10.0	10.0	-	7.66	8.80				
- TBA	-	-	-	-	-	-	-				

NOTE: A and B designate same company at different localities.

FIGURE D-1



MeOH
1:1 MEOH/TBA
EtOH
TBA
wt % oxygen
10
9
8
7
6
5
4
3
2
1
2
6
10
14
18
22
26
vol. % alcohol
Note: The correlation between volume percent alcohol and weight percent oxygen shown is only correct for a single-density fuel.

APPENDIX E

PROPOSED METHOD OF TEST FOR VAPOR/LIQUID RATIO OF GASOLINE (BOMB METHOD) AND RESULTS OF ON-SITE FUEL ANALYSIS USING BOMB METHOD

PROPOSED METHOD OF TEST FOR VAPOR/LIQUID RATIO OF GASOLINE (BOMB METHOD)

1. SCOPE

1.1 This method covers the determination of the temperature for a vapor/liquid (V/L) ratio of 20 for gasoline and gasoline-oxygenate blends.

2. APPLICABLE DOCUMENTS

2.1 ASTM Standards

D4057 Practice for Manual Sampling of Petroleum and Petroleum Products

D323 Test Method for Vapor Pressure of Petroleum Products (Reid Method)

3. SUMMARY OF METHOD

3.1 A measured volume of gasoline at 32 to 34°F (0 to 1°C) is introduced into a two piece bomb having a known volume 21 times the volume of gasoline sample used, and which is attached directly to a pressure gage. The bomb is placed in a constant temperature water bath and allowed to reach both temperature and pressure equilibrium. Using the pressure indicated by the gage, the vapor/liquid ratio is calculated at that temperature.

3.2 The vapor/liquid ratio is determined at two temperatures. The results are plotted and the temperature corresponding to a specific V/L is read.

4. SIGNIFICANCE

4.1 The tendency of a gasoline to vaporize in automobile fuel systems is indicated by the vapor/liquid ratio of that fuel at conditions approximating those in critical parts of the fuel systems.

5. DEFINITION

5.1 Vapor/liquid ratio of a fuel, at any specified temperature, is the ratio, at that temperature, of the volume of vapor in equilibrium with liquid to the volume of sample charged as a liquid at 32°F (0°C).

NOTE 1 - This ratio differs from the absolute vapor/liquid ratio because corrections are not made for, (1) liquid sample expansion with increasing temperature, (2) decrease in liquid sample volume by vaporization, (3) dissolved air in the liquid sample, and (4) deviation from the perfect gas law.

6. APPARATUS

6.1 V/L Apparatus - Constructed of stainless tubing and fittings and consisting of two chambers -- a vapor chamber (upper section) and a liquid chamber (lower section).

6.1.1 Vapor Chamber, shall conform to the dimensions shown in Figure A1.1 Method D323.

6.1.2 Liquid Chamber, shall conform to the dimensions shown in Figure 1.

6.2 Pressure Gage, 0-30 psig - The pressure gage shall conform to the specifications given in A1.2, Method D323.

6.3 Water Baths (2) - The water baths shall be of such dimensions that the V/L apparatus may be immersed to at least 1 inch (25 mm) above the top of the vapor chamber. Stirred and thermostatically controlled, capable of being adjusted to any temperature between 100°F (38°C) and 140°F (60°C) and maintaining the water temperature within ±0.2°F (0.1°C) of the desired temperature.

6.4 Cooling Bath - Capable of maintaining a temperature of 32 to 34°F (0 to 1°C).

7. HANDLING OF SAMPLES

7.1 The extreme sensitivity of vapor/liquid measurements to losses through evaporation and the resulting changes in composition is such as to require the utmost precaution and the most meticulous care in the handling of samples. The provisions of this section shall apply to all samples for V/L determinations.

7.2 Sampling shall be done in accordance with Method D4057 except that water displacement (11.3.1.8 of D4057) may not be used.

7.3 Sample Container Size - The size of the sample container from which the vapor pressure sample is taken shall be 1 qt. (1L). It shall be 70 to 80% filled with the sample.

7.4 Precautions

7.4.1 The vapor/liquid determination shall be the first test run on a sample, nor may more than one sample be withdrawn from the sample container for this test.

7.4.2 Samples shall be protected from excessive heat prior to testing.

7.4.3 Samples in leaky containers shall not be tested. They should be discarded and new samples obtained.

7.4.4 Samples that have separated into two phases should be discarded and new samples obtained.

7.5 Sample Handling Temperature - In all cases, the sample container and contents shall be cooled to 32 to 34°F (0 to 1°C) before the container is opened. Sufficient time to reach this temperature shall be assured by direct measurement of the temperature of a similar liquid in a like container placed in the cooling bath at the same time as the sample.

8. CALIBRATION

8.1 Measure the volumetric capacity of the V/L apparatus.

8.1.1 Prepare freshly boiled distilled water which has been cooled to room temperature in a sealed flask.

8.1.2 Disconnect the gage from the V/L apparatus and fill the V/L apparatus to the seat of the gage connection with water. Determine the weight of water required and the temperature of the water. Calculate the volume of the cylinder.

8.1.3 Fill the gage with water. Determine the weight of water required and the temperature of the water. Calculate the volume of the gage.

NOTE 2 - A hypodermic syringe may be useful in slowly adding water to assure that the Bourdon tube is filled with water.

8.1.4 The volumetric capacity of the V/L apparatus is the sum of the volumes determined in 8.1.2 and 8.1.3.

8.2 Measure the volumetric capacity of the liquid chamber.

8.2.1 Fill the liquid chamber alone with water. Determine the weight of water required and the temperature of the water. Calculate the volume of the liquid chamber.

NOTE 3 - The V/L apparatus is designed to have a volume approximately 21 times the volume of gasoline sample used.

9. PREPARATION FOR TEST

9.1 Adjustment of Constant-Temperature Baths - Adjust the water baths to the desired test temperature and maintain at that temperature ±0.2°F (0.1°C).

9.2 Verification of Sample Container Filling - With the sample at a temperature of 32 to 34°F (0 to 1°C), take the container from the cooling bath, wipe dry with an absorbent material, unseal it, and examine its ullage. The sample content, as determined by use of a suitable gage, shall equal 70 to 80% of the container capacity.

9.2.1 Discard the sample if its volume is less than 70% of the container capacity.

9.2.2 If the container is more than 80% full, pour out enough sample to bring the container contents within the 70 to 80% range. Under no circumstances may any sample poured out be returned to the container.

9.3 Air Saturation of Sample in Sample Container.

9.3.1 With the sample again at a temperature of 32 to 34°F (0 to 1°C), take the container from the cooling bath, unseal it momentarily, taking care that no water enters, reseal it, and shake it vigorously. Return it to the bath for a minimum of 2 minutes.

9.3.2 Repeat 9.3.1 twice more. Return the sample to the bath until the beginning of the procedure.

9.4 Preparation of Liquid Chamber - Observe the apparatus preparation procedure of Section 10.7, then store the stoppered liquid chamber and the sample transfer connection in a cooling bath for a sufficient time to allow the chamber and the connection to reach a temperature of 32 to 34°F (0 to 1°C). If an ice-water bath is used, keep the chamber upright and not immersed over the top of the coupling threads. The transfer connection may be inserted into a plastic bag to keep it completely dry during cooling.

9.5 Preparation of Vapor Chamber - Observe the apparatus preparation procedure of Section 10.7. Connect the gage to the vapor chamber and close the lower opening securely with a dry #6 1/2 rubber stopper. Make sure the stopper is inserted far enough to securely close the vent hole in the vapor chamber connection. Immerse the vapor chamber to at least 1" (25 mm) above its top in the water bath maintained at 100°±0.2°F (37.8±0.1°C) for not less than 20 minutes. Do not remove the vapor chamber from the water bath until the liquid chamber has been filled with the sample as described in 10.1.

10. PROCEDURE

10.1 Sample Transfer - With everything in readiness, remove the chilled sample container from the bath, uncap it, and insert the cilled transfer apparatus (see Figure 1, Method D323). Quickly place the chilled liquid chamber, in an inverted position, over the sample delivery tube of the transfer apparatus. Invert the entire system rapidly so that the liquid chamber is upright with the end of the delivery tube touching the bottom of the liquid chamber. Fill the liquid chamber to overflowing. Withdraw the delivery tube from the liquid chamber while allowing the sample to continue flowing up to the moment of complete withdrawal.

10.1.1 Caution - Provision should be made for suitable restraint and disposal of the overflowing gasoline to avoid fire hazard.

10.2 Assembly of Apparatus - Immediately remove the vapor chamber from the water bath and as quickly as possible dry the exterior of the chamber with absorbent material with particular care given to the connection between the vapor chamber and the liquid chamber. Remove the stopper after drying and immediately couple the two chambers. Not more than 10 s shall be consumed in coupling the two chambers.

NOTE 4 - When the vapor chamber is removed from the water bath, dried and the stopper removed, connect it to the liquid chamber without undue movements through the air which could promote exchange of room temperature air with the 100°F air in the chamber.

10.3 Introduction of Apparatus Into Bath - Turn the assembled vapor/liquid apparatus upside down to allow the sample in the liquid chamber to run into the vapor chamber. With the apparatus still inverted, shake it vigorously eight times in a direction parallel to the length of the apparatus. With the gage end up, immerse the assembled apparatus in the bath, maintained at 100±0.2°F (37.8±0.1°C), in an inclined position so that the connection of the liquid and vapor chambers is below the water level and may be carefully examined for leaks. If no leaks are observed, further immerse the apparatus to at least 1" (25 mm) above the top of the vapor chamber. Observe the apparatus for leakage throughout the test. Discard the test at any time a leak is detected.

NOTE 5 - Liquid Leaks are more difficult to detect than vapor leaks; and because the coupling between the chambers is normally in the liquid section of the apparatus, give it particular attention.

NOTE 6 - After the apparatus has been immersed in the bath, check the remaining sample for phase separation. If the sample is contained in a glass container, this observation can be made prior to sample transfer (10.1). If the sample is contained in a non-transparent container, pour a portion of the remaining sample into a clear glass container and observe for evidence of phase separation. If the sample is not clear and bright, discard the test and the sample.

10.4 Measurement of Vapor Pressure - After the assembled vapor/liquid apparatus has been immersed in the bath for at least 5 minutes, tap the pressure gage lightly and observe the reading. Withdraw the apparatus from the bath and repeat 10.3. At intervals of not less than 2 minutes, perform 10.3 until a total of not less than five shaking and gage readings have been made and continuing thereafter if necessary until the last two consecutive gage readings are constant, indicating equilibrium attainment. These operations normally require 20 to 30 minutes. Read the final gage pressure to the nearest 0.1 psi (0.5 kPa) and record the value as the uncorrected gage pressure.

10.5 Additional Measurement of Vapor Pressure - The V/L apparatus is immediately transferred to another water batch maintained at 130±0.2°F (54.5±0.1°C) and a measurement of gage pressure made following the procedure given in 10.4.

10.6 Without undue delay remove the pressure gage (Note 7) and, without attempting to remove any liquid which may be trapped in the gage, check its readings against that of a manometer while both are subjected to a common steady pressure which is no more than 0.2 psi (1.0 kPa) different from the uncorrected gage pressure recorded in 10.4 and 10.5. If a difference is observed between the gage and manometer readings, the differences should be added to or subtracted from the uncorrected gage pressure recorded in 10.4 and 10.5. The resulting values are recorded as final gage pressure at 100°F and 130°F.

NOTE 7 - Cooling the assembly prior to disconnecting the gage will facilitate disassembly and reduce the amount of hydrocarbon vapors released into the room.

NOTE 8 - *Verification of Sample Integrity - Disconnect the vapor* chamber from the liquid chamber. Drain the sample from the air and liquid chambers as completely as possible into a dry 8 oz. clear glass bottle. Seal the bottle and shake it vigorously for 5 seconds. If the sample is clear and bright and free of a second phase, note this observation and record that the test is valid. If the sample is not clear and bright and free of a second phase, note this observation and record that the test is not valid because of phase separation.

10.7 Preparation of Apparatus for Next Test - Disconnect the vapor and liquid chambers and discard contained sample. Thoroughly purge the vapor chamber of residual sample by filling it with warm water above 90°F (32°C) and allowing it to drain (Note 8). Repeat this purging at least five times. After disconnecting the pressure gage from its manifold connection with the manometer, remove trapped fluid in the Bourdon tube of the gage by repeated centrifugal thrusts. This may be accomplished in the following manner: hold the gage between the palms of the hands with the right hand on the face side and the threaded connection of the gage forward. Extend the arms forward and upward at an angle of 45° with the coupling of the gage pointing in the same direction. Swing the arms downward through an arc of about 135° so that the centrifugal force aids gravity in removing the trapped liquid.

Repeat this operation three times to expel all liquid. Purge the pressure gage by directing a small jet of air into its Bourdon tube for at least 5 minutes. Rinse both chambers and sample transfer connection several times with petroleum naphtha, then several times with acetone, then blow dry using dried air. Stopper the liquid chamber and place it in the cooling bath for the next test.

NOTE 9 - If the purging of the vapor chamber is done in a bath, be sure to avoid small and unnoticeable films of floating sample by keeping the bottom and top openings of the chamber closed as they pass through the water surface.

11. PRECAUTIONS

11.1 Gross errors can be obtained in vapor/liquid measurements if the prescribed procedure is not followed carefully. The following list emphasizes the importance of strict adherence to the precautions given in the procedure.

11.1.1 Checking the Pressure Gage - Check all gages against a manometer after each test in order to ensure higher precision of results (10.6). Read all gages while the gage is in a vertical position and after tapping it lightly.

11.1.2 Shake the container vigorously to ensure equilibrium of the sample with the air in the container (9.3).

11.1.3 Checking for Leaks - Check all apparatus before and during each test for both liquid and vapor leaks (10.3).

11.1.4 Sampling - Because initial sampling and the handling of samples will greatly affect the final results, employ the utmost precaution and the most meticulous care to avoid losses through evaporation and even slight changes in composition (Sections 7 and 10.1). In no case shall any part of the V/L apparatus itself be used as the sample container previous to actually conducting the test.

11.1.5 Purging the Apparatus - Thoroughly purge the pressure gage, the liquid chamber and the vapor chamber to be sure that they are free of residual sample. (This is most conveniently done at the end of the previous test.) (See 10.7.) It is important to remove all water from the apparatus before cooling the liquid chambers and heating the vapor chamber. In high humidity conditions, be alert for and avoid condensation on the transfer connection and the interior walls of the apparatus.

11.1.6 Coupling the Apparatus - Carefully observe the requirements of 10.2.

11.1.7 Shaking the Apparatus - Shake the apparatus "vigorously" as directed in 10.3 in order to ensure equilibrium.

12. CALCULATION

12.1 For each determination, calculate the vapor/liquid ratio as follows:

12.1.1 For 100°F (37.8°C) determination:

$$V/L = \frac{Vc - Vs}{Vs} \quad \frac{P1}{14.7}$$

Where: Vc = Void volume of the V/L apparatus, ml
Vs = Volume of sample, ml
P1 = Final gage pressure at 100°F (37.8°C), psi

12.1.2 For 130°F (54.5°C) determination:

$$V/L = \frac{Vc - Vs}{Vs} \quad \frac{P2 - 0.054B}{14.7}$$

Where: P2 = Final gage pressure at 130°F, psi
B = Barometer pressure at time of test, psi

NOTE 9 - The vapor/liquid ratio may be calculated at a temperature other than 130°F (54.4°C) as follows:

$$V/L = \frac{Vc - Vs}{Vs} \quad \frac{P3 + [(100-T)B/560]}{14.7}$$

Where: P3 = Final gage pressure at test temperature, psi
T = Test temperature, °F

12.2 Plot the experimental results in the form of vapor/liquid ratio versus temperature on graph paper which can be read easily to 0.1 V/L and 1°F (0.5°C). Read from this plot the temperature corresponding to a specific V/L ratio.

12.3 Report vapor/liquid ratio to the nearest 0.1 unit and the corresponding temperature to nearest 1°F (0.5°C).

13. PRECISION

13.1 To be determined.

APPENDIX F

SUMMARY OF RAW DATA

SAMPLE DATA SHEET

RUN NO.	2
VEHICLE NO.	1
INITIAL FILL:	////////
FUEL	8
GAL	3
FUEL	
GAL	
REFUEL FILL:	///////
FUEL	8
GAL	3
FUEL	
GAL.	
DRIVER NO.	4
DATE	10-Sep
TIME	1429
TEMP.	88
WIND	8
BAR PRESSURE	29.89
CL'D COVER	5

Ambient Temperature taken at start of test.

Sequence 1 Temperatures taken approximately 20 minutes into test.

Sequence 2 Temperatures taken approximately 40 minutes into test.

Sequence 3 Temperatures taken approximately 85 minutes into test.

Sequence 4 Temperatures taken approximately 90 minutes into test.

	MODE	INIT START SEC	..RESTART SEC	NO	IDLE ROUGH	IDLE STALL	.....DRIVING HES'T	STUMBLE	SURGE	B'FIRE	STALL	TANK	TEMP UNDER'HD	CARB.	FUEL SAMPLE	RVP	TWD
	INITIAL START	2	0	0	//////	//////	//////	//////	//////	//////	//////	//////	//////	//////	//////	////	0
	IDLE,PARK,3 min	/////////	0	0	0	0	//////	//////	//////	//////	//////				///////	////	0
	W.U.,15 miles	//////////	//////////		//////	//////	//////	//////	//////	//////	//////	//////	//////	//////	//////	////	//////
	REFUEL START	2	0	0	//////	//////	//////	//////	//////	//////	//////	//////	//////	//////	3332	1..5	0
	IDLE 30 sec,PARK	////////	0	0	0	0	//////	//////	//////	//////	//////	84	131	146	///////	////	0
Sequence 1--------	IDLE 30 sec,DR.	////////	0	0	0	0	//////	//////	//////	//////	//////	88	121	151	///////	////	0
	0 -10	////////	0	0	///////	///////	0	0	0	0	0	//////	//////	NO	///////	////	0
	0 -55	////////	0	0	///////	///////	0	3	0	0	0	//////	//////	NO	///////	////	24
	0 -55	////////	0	0	///////	///////	0	3	0	0	0	//////	//////	NO	///////	////	24
	0 -55	////////	0	0	///////	///////	0	3	0	0	0	//////	//////	NO	///////	////	24
	W.U.,5 miles	////////////	/////////		//////	//////	//////	//////	////	////	//////	//////	////	////	///////	/	//////////
Sequence 2--------	IDLE 10 min	////////	0	0	0	0	//////	//////	//////	//////	//////	101	113	183	3174	1.4	0
	BACK OUT	////////	0	0	//////	/////	0	0	0	0	0	//////	//////	//////	///////	////	0
	IDLE 15 sec	////////	0	0	0	0	//////	//////	//////	//////	//////	//////	//////	//////	///////	////	0
	0 -10	////////	0	0	//////	//////	1	1	0	0	0	//////	//////	//////	///////	////	12
	IDLE 15 sec	////////	0	0	0	0	//////	//////	//////	//////	//////	//////	//////	//////	///////	////	0
	0 -30	////////	0	0	///////	///////	0	1	0	0	0	//////	//////	//////	///////	////	6
	30	////////	0	0	///////	///////	0	0	1	0	0	//////	//////	//////	///////	////	4
	30 -45 DT	////////	0	0	///////	///////	0	2	0	0	0	//////	//////	//////	///////	////	12
	45	////////	0	0	///////	///////	0	0	1	0	0	//////	//////	//////	///////	////	4
	DECEL,15 mph	////////	0	0	///////	///////	0	0	0	0	0	//////	//////	//////	///////	////	0
	ABRUPT STOP	////////	0	0	0	0	//////	//////	//////	//////	//////	//////	//////	//////	///////	////	0
	0 -55 WOT	////////	0	0	///////	///////	0	3	0	0	0	//////	//////	NO	///////	////	24
	55	////////	0	0	///////	///////	0	0	1	0	0	//////	//////	NO	///////	////	4
	IDLE 15 sec	////////	0	0	0	0	//////	//////	//////	//////	//////	//////	//////	//////	///////	////	0
	0 -25	////////	0	0	///////	///////	1	1	0	0	0	//////	//////	//////	///////	////	12
	IDLE 10 sec	////////	0	0	0	0	//////	//////	//////	//////	//////	//////	//////	//////	///////	////	0
	0 -10	////////	0	0	///////	///////	0	0	0	0	0	//////	//////	//////	///////	////	0
	IDLE 10 sec	////////	0	0	0	0	//////	//////	//////	//////	//////	//////	//////	//////	///////	////	0
	0 -25	////////	0	0	///////	///////	1	1	0	0	0	//////	//////	//////	///////	////	12
	IDLE 10 sec	////////	0	0	0	0	//////	//////	//////	//////	//////	//////	//////	//////	///////	////	0

SAMPLE DATA SHEET - (Continued)

0 -10	////////		0	0	///////	///..//	0	0	0	0	0	//////	//////	//////	///////	/////	0
IDLE 10 sec	////////		0	0	0	0	//////	//////	//////	//////	//////	//////	//////	//////	///////	/////	0
0 -25	////////		0	0	///////	///////	0	0	0	0	0	//////	//////	//////	///////	/////	0
IDLE 10 sec	////////		0	0	0	0	//////	//////	//////	//////	//////	//////	//////	//////	///////	/////	0
0 -10	////////		0	0	///////	///////	0	0	0	0	0	//////	//////	//////	///////	/////	0
IDLE 10 sec	////////		0	0	1	0	//////	//////	//////	//////	//////	//////	//////	//////	///////	/////	1
0 -25	////////		0	0	///////	///////	1	0	0	0	0	//////	//////	//////	///////	/////	6
IDLE 10 sec	////////		0	0	0	0	//////	//////	//////	//////	//////	//////	//////	//////	///////	/////	0
0 -10	////////		0	0	///////	//////	0	0	0	0	0	//////	//////	//////	///////	/////	0
IDLE 10 sec	////////		0	0	0	0	//////	//////	//////	//////	//////	//////	//////	//////	///////	/////	0
0 -15	////////		0	0	//////	///////	0	1	0	0	0	//////	//////	//////	///////	/////	6
15 -55 CONST VAC	////////		0	0	///////	///////	0	2	0	0	0	//////	//////	NO	///////	/////	12
W.U. 10 miles	////////	////////	////////	//////	//////	//////	//////	//////	//////	//////	//////	//////	//////	//////	///////	//////////	//////
IDLE 2 min	////////		0	0	0	0	//////	//////	//////	//////	//////	//////	//////	//////	///////	/////	0
Sequence 3-------- SOAK 20 min	////////	////////	////////	//////	//////	//////	//////	//////	//////	//////	//////	113	136	157	2447	10.9	/////////
START		4	0	0	//////	//////	//////	//////	//////	//////	//////	//////	//////	//////	///////	/////	2
IDLE 1 min	////////		0	0	0	0	//////	//////	//////	//////	//////	//////	//////	//////	///////	/////	0
BACK OUT	////////		0	0	//////	//////	0	0	0	0	0	//////	//////	//////	///////	/////	0
IDLE 15 sec	////////		0	0	0	0	//////	//////	//////	//////	//////	//////	//////	//////	///////	/////	0
0 -10	////////		0	0	//////	///////	2	1	0	0	0	//////	//////	//////	///////	/////	18
IDLE 15 sec	////////		0	0	0	0	//////	//////	//////	//////	//////	//////	//////	//////	///////	/////	0
0 -30	////////		0	0	//////	//////	0	1	0	0	0	//////	//////	//////	///////	/////	6
30	////////		0	0	///////	///////	0	0	0	0	0	//////	//////	//////	///////	/////	0
30 -45	////////		0	0	///////	///////	0	2	0	0	0	//////	//////	//////	///////	/////	12
45	////////		0	0	///////	///////	0	0	0	0	0	//////	//////	//////	///////	/////	0
DECEL 15 mph	////////		0	0	///////	///////	0	0	0	0	0	//////	//////	//////	///////	/////	0
ABRUPT STOP	////////		0	0	0	0	//////	//////	//////	//////	//////	//////	//////	//////	///////	/////	0
0 -55 WOT	////////		0	0	///////	///////	0	3	0	0	0	//////	//////	NO	///////	/////	24
55	////////		0	0	///////	///////	0	0	0	0	0	//////	//////	NO	///////	/////	0
Sequence 4---------IDLE 15 SEC	////////		0	0	0	0	//////	//////	//////	//////	//////	117	120	133	///////	/////	0
															TOTAL TWD		249

INIT START DEM	RESTART DEM	IDLE DEM ROUGH	STALL	....DRIVING DEM HES'T	STUM	SURGE	B'FIRE	STALL	TWD
2	0	1	0	36	198	12	0	0	249

SUMMARY OF VOLATILITY RUNS - HIGH TEMPERATURE

| IDLE DEM | | DRIVING DEM |

RUN	VEHICLE	IFUEL1	IFUEL2	RFUEL1	RFUEL2	DRIVER	TEMP	INTSTART	RESTART	ROUGH	STALL	HESITATION	STUMBLE	SURGE	BACKFIRE	STALL	TWD	TANK1	UNDERHOOD1	CARBURETOR1	RVP1	TANK2	UNDERHOOD2	CARBURETOR2	RVP2	TANK3	UNDERHOOD3	CARBURETOR3	RVP3	TANK4	UNDERHOOD4	CARBURETOR4
1	1	6		6		4	88	0	0	0	0	24	144	0	0	0	168	83	110	156	15.6	103	122	174	14.9	110	120	155	11.9	115	116	127
2	1	8		8		4	88	2	0	1	0	18	192	12	0	0	225	88	121	151	14.5	101	113	183	13.4	113	136	157	10.9	117	120	133
3	1	5		5		4	97	0	0	0	0	6	36	0	0	0	42	92	116	155	9.3	118	116	182	8.8	122	135	157	7.9	123	127	132
4	1	10		10		4	95	1	0	8	0	18	180	4	0	0	211	96	125	152	14.4	105	118	185	13.7	114	145	163	10.0	120	124	139
5	1	8		8		4	94	1	1	9	8	6	168	4	0	0	197	97	112	159	14.1	103	112	187	13.5	102	140	165	10.6	118	123	139
6	1	3		3		4	99	0	2	2	8	24	36	0	0	32	104	95	120	159	8.3	120	124	195	7.9	120	122	165	7.2	126	130	141
7	1	7		7		4	92	0	0	18	0	60	150	4	0	0	232	90	120	157	13.1	101	111	180	15.0	114	125	161	11.4	118	117	132
8	1	4		4		4	95	0	0	4	0	12	66	0	0	0	82	100	122	160	12.8	111	116	186	11.8	122	141	167	9.6	126	128	145
9	1	1		1		4	88	0	0	0	0	0	0	0	0	0	0	90	120	144	10.3	118	120	177	10.1	120	132	160	8.8	120	125	132
10	1	6		6		4	92	0	2	15	8	30	144	0	0	32	231	94	130	151	15.3	106	122	189	14.3	121	143	164	10.8	126	126	139
11	1	9		9		4	90	0	0	11	0	12	174	8	0	0	205	86	115	147	15.9	101	114	185	14.9	115	136	163	10.8	122	122	137
12	1	2		2		4	94	0	0	7	0	0	156	16	0	0	179	88	112	148	10.0	114	118	190	10.1	116	132	157	8.6	116	123	132
13	1	1		1		4	90	0	0	1	0	0	30	0	0	0	31	88	115	145	10.3	117	120	186	10.1	126	142	164	9.4	126	130	138
14	1	5	10	5	10	4	91	0	0	5	0	42	90	0	0	0	137	92	115	149	10.8	110	114	186	12.2	118	136	161	9.6	124	125	140
15	1	5		5		4	94	0	0	1	8	0	30	0	0	0	39	86	117	142	9.3	116	115	187	9.0	124	141	164	8.6	131	130	142
16	1	2		2		4	89	1	0	2	0	12	18	0	0	0	33	90	113	146	12.1	112	116	176	9.4	119	127	157	8.6	121	125	128
17	1	10		10		4	86	1	0	11	0	6	150	4	0	0	172	89	116	142	15.1	103	111	174	14.1	113	132	153	11.7	117	116	127
18	1	10		10		4	87	2	0	10	0	6	126	0	0	0	144	82	109	142	15.4	100	107	174	14.4	112	134	154	11.8	116	116	127
19	1	11		11		4	91	0	0	9	0	6	144	8	0	0	167	85	109	152	15.2	101	108	179	14.6	113	124	158	11.2	120	119	132
1	2	6		6		2	90	0	0	0	8	0	0	0	0	0	8	88	126		15.5	100	102		14.7	107	146		12.2	108	108	
2	2	8		8		2	88	0	0	0	0	0	0	0	0	0	0	85	89		15.3	97	99		14.8	106	135		13.8	109	110	
3	2	10		10		2	96	0	2	0	8	0	0	0	0	0	10	128	90		14.6	105	103		13.8	113	144		11.0	128	115	
4	2	4		4		2	96	0	0	0	0	12	0	0	0	0	12	106	100		12.4	115	107		11.8	111	143		9.9	113	116	
5	2	9		9		2	94	2	0	0	0	0	0	0	0	0	2	115	94			106	101		14.3	111	132		11.6	116	110	
6	2	1		1		2	92	0	0	0	0	0	0	0	0	0	0	112	97		10.2	111	112		10.0	111	147		9.3	118	120	
7	2	2		2		2	90	0	0	0	0	0	0	0	0	0	0	110	95		10.0	110	102		9.8	114	141		9.5	115	117	
8	2	2		3		2	93	0	0	0	0	0	0	0	0	0	0	113	93		8.2	111	108		8.1	120	140		7.7	118	119	
9	2	5		5		2	93	0	0	1	0	0	0	0	0	0	1	107	102		9.0	108	112		9.0	129	141		8.4	120	117	
10	2	8		8		2	90	0	2	0	8	0	0	0	0	0	10	124	88		14.9	119	103		13.2	129	131		11.7	127	112	
11	2	7		7		2	94	0	1	0	24	18	0	0	0	0	43	111	94		15.2	112	104		12.3	120	138		10.4	122	115	
12	2	7		7		2	89	1	0	1	8	0	0	0	0	0	10	119	91		15.6	130	101		14.3	135	138		12.5	131	107	
13	2	11		11		2	87	0	1	2	8	0	0	0	0	0	11	108	87		15.2	116	99			123	129		12.9	121	105	

SUMMARY OF VOLATILITY RUNS - HIGH TEMPERATURE

| IDLE DEM | | DRIVING DEM

RUN	VEHICLE	IFUEL1	IFUEL2	RFUEL1	RFUEL2	DRIVER	TEMP	INTSTART	RESTART	ROUGH	STALL	HESITATION	STUMBLE	SURGE	BACKFIRE	STALL	TWD	TANK1	UNDERHOOD1	CARBURETOR1	RVP1	TANK2	UNDERHOOD2	CARBURETOR2	RVP2	TANK3	UNDERHOOD3	CARBURETOR3	RVP3	TANK4	UNDERHOOD4	CARBURETOR4
1	3	8		8		3	88	0	2	10	48	30	12	0	0	64	166	78	125	155	15.6	97	125	164	14.4	104	135	155	11.9	107	124	126
2	3	10		10		3	95	1	0	4	80	12	30	0	0	64	191	82	131	166	14.3	108	137	181	13.7	115	130	169	10.8	113	131	145
3	3	5		5		3	97	0	0	4	0	24	0	0	0	0	28	88	134	165	9.4	104	140	171	8.9	110	147	160	8.7	111	123	129
4	3	8		8		3	94	2	0	7	48	24	12	0	0	64	157	87	127	167	14.9	109	135	179	13.8	111	136	163	11.1	111	126	128
5	3	3		3		3	99	0	0	11	8	0	30	0	0	0	49	86	149	165	8.3	106	151	183	7.9	114	134	163	7.6	114	128	132
6	3	7		7		3	94	0	0	27	40	24	42	4	0	64	201	78	135	167	15.5	101	145	178	14.3	120	146	171	11.1	114	129	131
7	3	4		4		3	95	0	0	17	8	6	42	20	0	32	125	79	172	148	12.7	106	188	144	11.8	114	169	146	9.5	114	135	131
8	3	1		1		3	86	0	0	7	0	6	18	0	0	0	31	80	133	158	10.5	100	145	170	10.0	114	138	168	9.1	110	123	127
9	3	6		6		3	93	0	0	7	72	0	36	0	0	288	403	78	138	161	14.6	102	143	174	13.8	110	140	162	10.7	111	123	126
10	3	9		9		3	90	0	0	22	32	0	60	0	0	224	338	78	137	160	15.7	102	142	172	14.3	109	137	163	10.9	111	127	129
11	3	2		2		3	95	0	0	8	0	0	36	0	0	0	44	85	141	162	9.9	103	143	180	9.4	105	115	147	8.8			
12	3	5	10	5	10	3	90	0	0	12	0	0	48	0	0	64	124	89	131	163	12.7	105	138	168	11.2	115	141	162	10.2	113	123	126
13	3	5		5		3	94	0	0	10	0	0	42	0	0	0	52	91	137	159	9.2	116	158	186	8.8	122	148	168	8.3	120	130	132
14	3	1		1		3	90	0	0	7	0	6	24	0	0	0	37	82	137		10.5	104	148		9.9	115	144		8.8	114	123	
15	3	8		8		3	88	0	0	17	0	12	54	0	0	96	179	75	120	146	15.0	101	136	167	14.0	111	139	163	11.6	106	116	118
16	3	4		4		3	88	0	0	10	0	0	6	0	0	0	16	83	135	158	12.8	102	145	167	11.6	105	126	153	10.5	106	114	124
17	3	10		10		3	87	0	0	19	0	0	24	0	0	64	107	73	129	157	15.2	105	144	174	14.4	103	125	153	12.1	104	116	119
18	3	6		6		3	87	1	0	12	0	6	18	0	0	256	293	72	128	147	15.9	95	134	158	14.9	113	135	160	11.9	109	124	127
1	4	6		6		2	90	0	0	0	0	60	30	16	0	0	106	94	186	117	15.6	112	189	135	15.3	105	142	127	14.3	104	141	100
2	4	8		8		2	88	0	0	0	0	36	0	0	0	0	36	98	207	129	14.9											
3	4	5		5		2	97	0	0	1	0	54	0	0	0	0	55	99	142	121	9.4	101	203	155	9.1	95	168	148	8.8	106	147	108
4	4	10		10		2	95	0	1	11	8	246	0	0	0	0	266	108	204	138	14.3	101	192	149	14.2	103	169	151	11.6	117	169	116
5	4	8		8		2	94	0	0	14	0	228	0	0	0	0	242	117	188	136	14.1	105	193	142	13.8	94	162	152	12.2	115	182	116
6	4	3		3		2	99	0	0	0	0	108	0	0	0	0	108	102	226	156	8.5	111	216	165	8.3							
7	4	3		3		2	96	0	0	0	0	72	0	0	0	32	104				12.7	109	197	143	12.1	102	168	151	8.1	112	169	116
8	4	7		7		2	90	2	0	17	8	102	12	0	0	96	237	112	197	127	14.1	107	153	114	13.4	98	167	131	12.3	106	163	112
9	4	4		4		2	95	0	1	1	8	72	0	4	0	32	118	101	227	137	12.9	104	177	135	12.5	108	136	155	10.6	111	168	113
10	4	1		1		2	86	0	0	1	0	60	0	0	0	0	61	80	203	123	10.4	97	182	133	10.6	108	157	152	9.9	108	150	105
11	4	9		9		2	90	1	0	5	0	156	0	0	0	0	162	81	188	125	15.7	97	168	137	15.2	106	147	149	12.1	106	158	108
12	4	2		2		2	94	0	0	5	0	102	0	0	0	32	139	91	224	130	15.1	104	176	130	9.8	113	162	155	9.3	110	165	113
13	4	8		8		2	90	1	0	7	0	174	0	36	0	0	218	87	209	123	14.7	97	188	133	14.4	104	148	146	12.5	104	158	109
14	4	5		5		2	95	0	0	7	0	66	0	0	0	0	73	92	212	132	9.2	106	175	131	9.0	116	171	159	8.6	113	161	116

SUMMARY OF VOLATILITY RUNS - HIGH TEMPERATURE

IDLE DEM	DRIVING DEM

RUN	VEHICLE	IFUEL1	IFUEL2	RFUEL1	RFUEL2	DRIVER	TEMP	INTSTART	RESTART	ROUGH	STALL	HESITATION	STUMBLE	SURGE	BACKFIRE	STALL	TWD	TANK 1	UNDERHOOD 1	CARBURETOR 1	RVP 1	TANK 2	UNDERHOOD 2	CARBURETOR 2	RVP 2	TANK 3	UNDERHOOD 3	CARBURETOR 3	RVP 3	TANK 4	UNDERHOOD 4	CARBURETOR 4
15	4	5	10	5	10	2	91	0	0	4	0	84	0	0	0	0	88	92	198	126	11.9	102	174	127	11.0	112	160	155	10.8	113	164	113
16	4	1		1		2	90	0	0	0	0	120	0	0	0	0	120	88	199	124	10.0	100	193	137	10.1	112	155	157	9.4	111	160	111
17	4	6		6		2	91	1	0	0	0	228	0	8	0	0	237	85	218	129	15.0	99	179	132	13.1	110	168	160	11.8	109	165	114
18	4	4		4		2	88	1	0	1	0	42	0	12	0	32	88	85	195	116	12.3	103	210	136	11.4	100	137	147	10.9	104	129	101
19	4	2		2		2	87	0	0	10	0	24	0	0	0	32	66	89	209	124	9.8	106	209	138	9.6	108	144	142	9.5	106	143	104
20	4	10		10		2	87	4	0	4	0	96	0	4	0	0	108	84	200	119	15.0	97	187	134	14.8	104	154	146	12.7	105	153	105
21	4	6		6		2	87	2	0	0	0	96	0	8	0	0	106	85	197	122	15.9	99	215	150	15.6	106	150	161	12.8	106	161	114
22	4	11		11		2	90	3	0	0	8	120	0	0	0	0	131	83	214	128	14.8	102	200	147	14.7	108	162	158	12.6			
1	5	6		6		4	90	0	0	0	0	0	0	0	0	0	0	87	105		15.4	98	113		14.0	106	134		11.5	108	113	
2	5	8		8		4	87	0	0	1	0	6	6	0	0	0	13	83	100		15.1	99	115		14.1	106	142		11.2	108	112	
3	5	10		10		4	96	1	0	9	0	6	72	4	0	0	92	89	110		13.7	107	124		12.7	115	149		9.7	117	122	
4	5	7		7		4	96	0	0	15	0	18	24	4	0	0	61	90	109		15.1	105	121		14.0	112	138			114	119	
5	5	4		4		4	96	0	0	2	0	0	6	4	0	0	12	87	108		12.5	105	126		11.7	113	152		9.3	114	120	
6	5	9		9		4	92	0	0	5	0	6	18	4	0	0	33	88	109		15.2	105	120		14.2	110	139		10.7	113	118	
7	5	2		2		4	90	1	0	1	0	0	6	0	0	0	8	87	102		9.9	109	124		9.6	114	141		8.6	116	121	
8	5	3		3		4	92	0	0	1	0	0	6	0	0	0	7	88	111		8.1	111	126		8.0	116	149		7.5	117	123	
9	5	8		8		4	90	0	0	2	0	0	6	0	0	0	8	87	107		14.5	107	124		13.8	112	148		10.2	116	122	
10	5	12		12		4	94	0	0	0	0	0	0	0	0	0	0	94	116		8.9	109	128		8.7	115	148		7.9	115	126	
11	5	5		5		4	93	0	0	0	0	30	0	0	12	0	42	91	115		9.7	109	128		8.7	112	148		8.2	112	127	
12	5	1		1		4	92	0	0	1	0	0	12	0	0	0	13	94	113		10.3	110	129		9.8	118	138		8.6	120	126	
1	6	6		6		3	90	0	0	5	8	0	0	0	0	0	13	85	101		15.4	102	111		14.8	105	129		12.9	108	113	
2	6	10		10		2	93	0	0	4	0	0	0	0	0	0	4	87	103		14.5	102	108		14.1	111	151		11.3	116	121	
3	6	5		5		2	96	0	0	0	0	0	0	0	0	0	0	88	107		9.4	108	117		9.1	124	158		8.7	120	125	
4	6	8		8		2	94	0	0	4	0	12	0	0	0	0	16	88	103		14.1	101	108		14.3	114	152		10.9	113	119	
5	6	3		3		2	97	0	0	0	0	0	0	0	0	0	0	89	110		8.5	110	117		8.2	121	152		7.9	116	121	
6	6	7		7		2	94	0	0	4	0	0	0	0	0	0	4	85	111		14.7	102	110		14.6	115	146		11.0	111	116	
7	6	4		4		2	95	0	0	0	8	0	0	0	0	0	8	90	108		12.6	103	110		11.8	119	150		9.8	119	124	
8	6	1		1		2	85	0	0	0	0	0	0	0	0	0	0	83	105		10.3	100	112		9.9	113	147		9.4	109	116	
9	6	6		6		2	92	0	0	0	0	6	0	0	0	0	6	87	103		14.9	100	112		13.8	108	145		11.4	110	115	
10	6	9		9		2	92	0	0	1	0	6	0	0	0	0	7	81	99		15.[illegible]	105	115		14.9	111	148		11.2	112	118	

SUMMARY OF VOLATILITY RUNS - HIGH TEMPERATURE

IDLE DEM | DRIVING DEM

RUN	VEHICLE	IFUEL1	IFUEL2	RFUEL1	RFUEL2	DRIVER	TEMP	INTSTART	RESTART	ROUGH	STALL	HESITATION	STUMBLE	SURGE	BACKFIRE	STALL	TWD	TANK1	UNDERHOOD1	CARBURETOR1	RVP1	TANK2	UNDERHOOD2	CARBURETOR2	RVP2	TANK3	UNDERHOOD3	CARBURETOR3	RVP3	TANK4	UNDERHOOD4	CARBURETOR4
11	6	2		2		2	94	0	0	1	0	0	0	0	0	0	1	86	105		10.1	98	108		9.8	112	141		9.2	107	113	
12	6	1		1		2	90	0	0	0	0	6	0	0	0	0	6	94	111		10.1	104	116		9.6	118	150		9.2	118	122	
13	6	8		8		2	95	0	0	4	8	0	0	0	0	0	12	87	102		14.6	102	108		14.0	111	147		10.8	111	116	
14	6	11		11		2	94	0	0	2	0	0	0	0	0	0	2	89	103		13.8	102	107		13.0	114	152		10.5	115	120	
15	6	10		10		2	87	0	0	1	0	0	0	0	0	0	1	82	98		15.1	96	105		14.7	104	142		12.2	107	112	
16	6	11		11		2	91	0	0	1	0	0	0	0	0	0	1	83	100		15.1	101	111		14.4	108	146		11.7	109	114	
1	7	10		10		3	97	0	1	11	16	48	36	0	0	0	112	87	117	150	14.2	101	120	159	14.3	108	139	153	11.3	111	115	122
2	7	4		4		3	96	0	0	11	16	180	6	0	0	0	213	90	117	147	12.2	105	114	151	11.6	111	135	154	9.9	112	115	116
3	7	6		6		3	90	0	0	19	0	18	60	4	0	64	165	84	109	142	15.0	104	115	144	14.2	115	138	159	11.8	113	113	117
4	7	9		9		3	94	0	0	16	0	54	30	0	0	64	164	88	124	146	15.0	105	121	158	14.2	109	129	153	12.0	109	110	114
5	7	1		1		3	92	0	0	8	0	36	18	4	0	64	130	91	121	141	10.1	108	112	150	9.8	113	137	153	8.8	114	114	115
6	7	2		2		3	90	0	0	11	0	60	18	8	0	64	161	85	117	136	9.8	110	114	152	9.6	118	139	155	8.7	115	116	114
7	7	3		3		3	93	0	0	8	0	12	18	4	0	64	106	90	119	144	8.1	109	112	153	8.0	119	138	155	7.8	117	116	117
8	7	5		5		3	95	0	0	11	0	102	0	0	0	64	177	92	123	143	9.0	112	116		8.6	115	142		8.0	116	117	
9	7	8		8		3	90	0	0	13	0	144	0	0	0	64	221	83	116	141	14.5	103	118	151	14.1	112	136	153	11.3	114	116	120
10	7	7		7		3	95	0	0	9	0	24	42	0	0	64	139	87	123	146	9.0	102	117	150	14.4	110	137	154	11.5	111	114	119
11	7	10		10		3	89	0	0	10	0	42	24	0	0	64	140	83	116	136	14.5	101	117	156	14.0	104	127	146	14.0	106	108	109
12	7	10		10		3	87	0	0	2	0	0	36	0	0	64	102	83	114	134	14.9	100	114	146	14.4	105	130	146	12.4	107	107	112
13	7	11		11		3	91	1	0	12	0	6	30	4	0	64	117	83	110	143	14.8	97	110	154	14.5	107	136	151	12.5	110	113	117
14	7	6		6		3	90	0	0	6	0	0	48	0	0	64	118	84	114	146	15.1	98	114	157	14.8	103	127	151	13.1	105	107	115
1	8	6		6		1	88	0	0	2	0	6	0	16	0	0	24	92	130		14.8	107	125		14.8	108	148		13.0	108	122	
2	8	8		8		1	88	0	5	5	32	24	0	36	0	0	102	93	130		14.8	106	127		14.3	112	158		12.3	113	128	
3	8	10		10		1	93	0	0	3	32	0	60	0	0	0	95	92	136		14.7	111	133		14.1	119	164		11.4	119	136	
4	8	5		5		1	96	0	0	1	0	0	0	0	0	0	1	97	141		9.3	113	139		9.0	119	161		8.3	120	136	
5	8	8		8		1	93	0	1	4	8	0	0	0	0	0	13	95	134		14.1	111	130		13.6	115	162		11.9	115	132	
6	8	3		3		1	99	0	0	0	0	0	6	0	0	0	6	98	143		8.4	114	142		8.3	119	163		7.8	120	137	
7	8	7		7		1	96	0	0	1	8	0	18	0	0	0	27	90	137		15.2	109	135		14.4	112	162		11.6	112	132	
8	8	4		4		1	95	0	0	0	0	0	0	0	0	0	0	94	139		12.4	112	138		12.1	119	160		10.1	119	136	
9	8	6		6		1	92	0	0	3	16	0	0	32	0	0	51	95	142		14.9	110	135		14.3	114	162		12.3	115	130	
10	8	9		9		1	92	0	1	0	24	0	0	0	0	0	25	91	136		15.4	109	135		11.1	114	161		11.6	116	134	
11	8	1		1		1	92	0	0	4	0	0	6	0	0	0	10	97	137		10.1	115	140		9.7	121	158		8.6	123	137	

SUMMARY OF VOLATILITY RUNS - HIGH TEMPERATURE

IDLE DEM | DRIVING DEM

RUN	VEHICLE	IFUEL1	IFUEL2	RFUEL1	RFUEL2	DRIVER	TEMP	INTSTART	RESTART	ROUGH	STALL	HESITATION	STUMBLE	SURGE	BACKFIRE	STALL	TWD	TANK1	UNDERHOOD1	CARBURETOR1	RVP1	TANK2	UNDERHOOD2	CARBURETOR2	RVP2	TANK3	UNDERHOOD3	CARBURETOR3	RVP3	TANK4	UNDERHOOD4	CARBURETOR4
12	8	2		2		1	90	0	0	9	0	0	0	0	0	0	9	94	134		9.9	109	133		9.7	118	161		9.0	119	131	
13	8	3		3		1	91	0	0	15	0	0	0	0	0	32	47	95	138		8.3	112	139		8.2	118	162		7.9	118	135	
14	8	5		5		1	94	0	0	14	0	6	12	0	0	32	64	97	140		9.0	115	140		8.8	122	166		8.3	122	138	
15	8	10		10		1	88	0	0	15	8	0	6	0	0	0	29	89	134		14.8	105	122		14.5	111	149		13.0	112	123	
16	8	6		6		1	87	0	0	11	8	0	0	24	0	0	43	86	127		15.7	105	129		15.3	113	158		13.1	115	129	
17	8	1		1		1	91	0	0	9	0	0	0	0	0	0	9	95	135		10.9	112	139		10.7	117	159			117	132	
1	9	6		6		3	90	0	0	15	0	12	48	0	0	0	75	84	91		15.6	95	110		15.2	102	116		12.9	102	110	
2	9	8		8		3	88	0	0	9	0	6	72	0	0	0	87		88		14.6	95	109		14.3	103	122		12.5	104	109	
3	9	10		10		3	91	0	0	15	0	6	30	4	0	0	55	86	93		14.6	102	115		14.4	108	120		11.6	109	116	
4	9	5		5		3	96	0	0	16	0	0	30	0	0	0	46	93	100		9.4	103	120		9.1	114	126		8.7	113	120	
5	9	8		8		3	93	0	0	17	0	0	60	0	0	0	77	89	91		13.9	99	113		13.8	107	121		11.6	107	112	
6	9	3		3		3	99	0	0	16	0	0	6	0	0	0	22	90	101		8.6	104	119		8.1	116	129		7.9	116	122	
7	9	7		7		3	90	0	0	26	0	48	48	4	0	0	126	84	88		15.4	98	111		15.1	107	118		11.9	107	112	
8	9	4		4		3	95	0	0	19	0	24	42	0	0	0	85	89	92		12.5	105	125		12.1	116	128		9.8	115	121	
9	9	1		1		3	85	0	0	14	0	12	24	0	0	0	50	83	90		10.3	95	112		10.1	105	114		9.4	104	113	
10	9	9		9		3	92	0	0	14	0	48	48	0	0	0	110	85	89		15.1	96	110		14.6	108	128		14.6	108	113	
11	9	1		1		3	90	0	0	16	0	0	18	0	0	0	34	89	94		10.5	100	116		10.3	112	122		9.8	113	117	
12	9	2		2		3	91	0	0	13	0	12	12	0	0	0	37	86	93		9.8	104	120		9.6	113	117		8.9	112	118	
13	9	3		3		3	95	0	0	13	0	0	24	0	0	0	37	90	95		8.2	104	122		8.1	113	128		7.7	113	120	
14	9	5		5		3	94	0	0	15	0	0	6	0	0	0	21	91	92		9.0	106	123		8.9	117	125		8.2	115	122	
15	9	10		10		3	87	0	0	21	0	54	24	0	0	0	99	84	85		15.0	93	108		14.8	100	114		12.8	101	107	
16	9	6		6		3	90	0	0	21	0	30	12	0	0	0	63	90	89		15.2	101	118		14.8	106	117		12.3	106	113	
1	10	6		6		1	90	0	0	0	0	12	0	24	0	0	36	82	131		15.7	95	140		15.2	97	118		13.4	100	113	
2	10	8		8		1	87	3	0	0	0	0	6	0	0	0	9	84	121		15.4	93	131		15.0	96	134		13.1	100	108	
3	10	10		10		1	96	2	0	0	0	0	6	16	0	0	24	90	133	140	14.7	102	131	149	14.1	106	135	153	11.7	110	117	134
4	10	7		7		1	90	0	0	1	0	0	0	4	0	0	5	86	124	133	15.6	96	131	142	15.2	100	129	148	12.7	111	118	138
5	10	4		4		1	95	0	0	0	0	0	0	4	0	0	4	88	137	138	12.8	99	152	142	12.2	106	145	159	10.3	116	124	144
6	10	1		1		1	86	0	0	0	0	0	0	0	0	0	0	84	145	135	10.4	95	166	154	10.1	101	118	147	9.5	105	126	119
7	10	6		6		1	91	0	0	4	0	0	0	16	0	0	20	84	154	150	15.2	97	158	161	14.6	102	122	148	12.1	106	126	128
8	10	9		9		1	90	0	0	3	8	0	6	28	0	0	45	84	141	141	15.7	96	146	161	15.2	102	124	154	12.6	106	123	132
9	10	2		2		1	95	0	0	0	0	6	6	8	0	0	20	88	146	136	10.0	100	152	152	9.8	101	121	144	9.3	103	130	124

SUMMARY OF VOLATILITY RUNS - HIGH TEMPERATURE

										IDLE DEM		DRIVING DEM																				
RUN	VEHICLE	IFUEL1	IFUEL2	RFUEL1	RFUEL2	DRIVER	TEMP	INTSTART	RESTART	ROUGH	STALL	HESITATION	STUMBLE	SURGE	BACKFIRE	STALL	TWD	TANK1	UNDERHOOD1	CARBURETOR1	RVP1	TANK2	UNDERHOOD2	CARBURETOR2	RVP2	TANK3	UNDERHOOD3	CARBURETOR3	RVP3	TANK4	UNDERHOOD4	CARBURETOR4
10	10	1		1		1	90	0	0	0	0	0	0	0	0	0	0	84	149	134	10.3	99	164	154	10.1	106	123	155	9.3	109	131	132
11	10	3		3		1	92	0	2	0	16	0	6	20	0	0	44	87	143	137	8.2	101	153	157	8.1	106	121	147	7.7	109	138	131
12	10	8		8		1	90	0	0	3	8	0	24	16	0	0	51	83	132	133	14.8	95	143	154	14.4	102	121	152	12.2	106	127	133
13	10	10		10		1	87	0	0	5	0	0	0	16	0	0	21	86	138	137	14.6	94	143	157	14.3	100	110	142	12.2	104	120	126
14	10	5		5		1	86	2	0	2	0	6	0	8	0	0	18	86	144	138	9.7	95	152	153	9.6	97	130	148	9.3	97	122	122
15	10	5		5		1	87	1	0	5	0	12	0	4	0	0	22	87	144	137	9.5	97	156	158	9.3	103	121	150	8.8	105	133	127
16	10	11		11		1	91	1	0	7	0	12	0	20	0	0	40	81	135	139	15.1	95	144	156	14.7	99	126	147	12.6	106	126	133
17	10	11		11		1	91	1	0	8	0	12	0	0	0	0	21	86	139	143	15.2	96	143	163	14.9	100	124	151	12.7	104	120	131
1	11	10		10		4	91	2	0	0	0	12	36	16	0	0	66	89	118	158	15.2	103	118	175	14.2	110	154	161	11.2	112	114	156
2	11	5		5		4	97	2	0	1	0	12	12	8	0	0	35	90	113	150	12.4	108	119	172	9.1	117	150	155	8.8	118	121	153
3	11	8		8		4	93	1	0	1	0	6	24	16	0	0	48	89	113	152	13.9	99	105	158	13.6	106	140	153	12.2	108	111	153
4	11	3		3		4	99	1	0	0	0	0	12	0	0	0	13	92	110	169	8.5	108	118	189	8.1	117	150	160	7.6	118	121	157
5	11	7		7		4	97	2	0	0	0	24	96	28	6	0	156	90	109	165	11.2	102	116	184	14.5	105	143	152	10.1	106	111	151
6	11	4		4		4	95	1	0	1	0	36	54	8	0	32	132	89	111	162	12.5	105	121	173	12.7	124	146	159	10.3	114	118	152
7	11	1		1		4	85	0	0	1	0	12	36	8	0	0	57	[illegible]	110	145	10.4	104	117	167	10.2	111	137	150	9.7	110	111	138
8	11	6		6		4	91	2	0	4	0	0	66	40	0	0	112	85	109	154	15.1	95	114	170	14.3	103	141	147	13.1	105	104	135
9	11	9		9		4	91	1	0	3	0	6	66	12	0	64	152	94	113	155	15.1	107	114	168	14.0	112	150	160	10.1			
10	11	2		2		4	94	1	0	3	0	0	96	24	12	32	168	86	105	159	10.0	106	114	167	9.9	110	117	144	9.5	110	112	145
11	11	1		1		4	90	2	0	0	0	0	30	0	0	0	32	90	112	154	10.2	110	124	168	10.1	117	146	158	9.2	118	119	152
12	11	5	10	5	10	4	95	2	0	0	0	24	60	20	0	0	106	95	111	159	12.0	108	116	169	11.8	112	150	155	10.6	114	114	149
13	11	5		5		4	90	2	0	0	0	6	24	4	0	0	36	83	101	149	9.3	106	112	162	9.1	114	143	156	8.7	115	119	147
14	11	10		10		4	94	2	0	0	0	0	36	4	0	0	42	89	108	156	12.2	105	115	170	14.0	109	146	158	11.5	112	111	152
15	11	3		3		4	86	2	0	0	0	0	24	0	0	0	26	86	105	145	8.3	105	112	162	8.2	111	127	149	8.2	112	112	141
16	11	5		5		4	87	1	0	19	0	0	78	36	24	0	158	90	107	148	9.1	108	113	159	9.1	111	130	144	8.6	109	110	136
17	11	10		10		4	87	2	0	2	0	30	42	20	6	0	102	82	107	144	14.9	99	110	162		105	143	150	12.7	107	106	142
18	11	6		6		4	87	1	0	0	0	0	72	28	12	0	113	82	111	148	15.9	98	109	162	15.5	105	142	155	13.1	107	110	150
19	11	2		2		4	90	1	0	1	0	24	66	32	12	0	136	88	111	152	10.6	105	115	169	10.5	113	141	153	9.7	114	116	149
1	12	10		10		1	95	0	0	4	32	0	0	0	0	0	36	94			14.7	108	113		14.4	115	133		12.4	116	120	
2	12	5		5		1	96	0	0	0	0	0	0	0	0	0	0	96	108		9.4	107	109		9.3	109	111		9.1	108	110	
3	12	8		8		1	94	0	4	1	24	0	0	0	0	0	29	90	107		14.7	104	109		14.5	113	130		13.0	112	117	
4	12	3		3		1	97	0	0	1	0	0	0	0	0	0	1	98	112		8.5	108	112		8.3	113	120		8.2	115	116	
5	12	7		7		1	96	0	0	5	32	0	24	0	0	0	61	91	106		15.3	106	112		14.9	110	122		12.8	113	117	
6	12	4		4		1	96	0	0	0	16	0	0	0	0	0	16	91	104		12.7	106	108		12.6							

SUMMARY OF VOLATILITY RUNS - HIGH TEMPERATURE

| IDLE
DEM | | DRIVING DEM |

RUN	VEHICLE	IFUEL1	IFUEL2	RFUEL1	RFUEL2	DRIVER	TEMP	INTSTART	RESTART	ROUGH	STALL	HESITATION	STUMBLE	SURGE	BACKFIRE	STALL	TWD	TANK1	UNDERHOOD1	CARBURETOR1	RVP1	TANK2	UNDERHOOD2	CARBURETOR2	RVP2	TANK3	UNDERHOOD3	CARBURETOR3	RVP3	TANK4	UNDERHOOD4	CARBURETOR4
1	13	1		1		1	85	0	0	0	0	0	0	0	0	0	0	110	115		10.1	119	124		9.5	108	123		10.3	119	128	
2	13	6		6		1	90	0	0	0	0	0	0	0	0	0	0				12.8				12.7	108	132		11.9	123	132	
3	13	9		9		1	94	0	8	0	8	0	0	0	0	0	16	100	111		13.1	116	120		13.3	108	130		11.1	119	130	
4	13	1		1		1	90	0	0	0	0	0	0	0	0	0	0	116	122		10.8	129	135		9.2	116	143		9.5	127	138	
5	13	2		2		1	91	0	0	0	0	0	0	0	0	0	0	111	116		9.8	125	128		9.5	113	130		9.2	123	132	
6	13	3		3		1	95	0	0	0	0	0	0	0	0	0	0	111	118		8.4	126	130		8.7	115	139		8.2	126	134	
7	13	5		5		1	90	0	0	0	0	0	0	0	0	0	0	110	115		10.1	122	125		9.1	111	138		8.6	120	130	
8	13	8		8		1	94	0	0	0	0	0	0	0	0	0	0	102	114		14.3	113	120		12.3	110	132		11.0	120	133	
9	13	7		7		1	94	0	0	0	0	0	0	0	0	0	0	102	116		14.7	120	124		12.9	109	141		10.9	120	133	
10	13	4		4		1	87	0	0	0	0	0	0	0	0	0	0	110	120		11.9	124	128		9.9	107	130		9.6	120	129	
11	13	10		10		1	87	0	0	0	0	0	0	0	0	0	0	99	112		15.0	116	120		13.2	106	138		12.0	116	130	

SUMMARY OF VOLATILITY RUNS - INTERMEDIATE TEMPERATURE

RUN	VEHICLE	IFUEL1	IFUEL2	RFUEL1	RFUEL2	DRIVER	TEMP	INTSTART	RESTART	ROUGH	STALL	HESITATION	STUMBLE	SURGE	BACKFIRE	STALL	TWD	TANK1	UNDERHOOD1	CARBURETOR1	RVP1	TANK2	UNDERHOOD2	CARBURETOR2	RVP2	TANK3	UNDERHOOD3	CARBURETOR3	RVP3	TANK4	UNDERHOOD4	CARBURETOR4
										IDLE DEM		DRIVING DEM																				
1	1	5		5		4	74	0	0	0	0	0	0	0	0	0	0	75	84	89	9.1	93	97	141	9.0	97	100	129	8.8	98	103	104
2	1	6		6		4	79	1	2	0	16	0	78	0	0	0	97	78	97	135	15.8	92	108	166	15.1	108	133	150	12.7	114	119	128
3	1	8		8		4	75	2	0	0	0	18	66	12	0	0	98	75	93	153	15.2	95	103	163	14.7	101	110	144	13.2	105	104	112
4	1	10		10		4	79	0	0	0	0	18	84	16	0	32	150	78	92	136	15.1	93	96	172		92	113	140		96	102	116
5	1	9		9		4	58	0	0	1	0	18	42	0	0	0	61	63	84	113	16.4	79	91	140	16.1	90	112	136		98	98	105
6	1	7		7		4	79	0	1	4	16	12	174	0	0	0	207	89	113	141	16.0	99	113	183	15.2	108	135	152	11.6	115	116	126
7	1	6		6		4	75	0	0	21	8	36	138	8	0	0	211	78	100	91	15.7	96	102	164	15.3	105	126	150	13.4	110	111	118
8	1	1		1		4	69	0	0	1	0	0	6	0	0	0	7	77	104	122	10.7	102	101	160	10.6	104	116	143	10.0	104	110	113
1	2	6		6		2	74	0	0	0	0	0	0	0	0	0	0	76	85		15.5	88	90		15.8	95	120		14.5			
2	2	8		8		2	74	0	0	1	0	0	0	0	0	0	1	78	81		14.7	87	89		14.8	98	128		14.2	98	98	
3	2	10		10		2	78	0	0	0	0	0	0	0	0	0	0	78	81		15.1	86	88		14.9	91	105		14.3	92	93	
4	2	9		9		2	83	0	0	0	8	0	0	0	0	0	8	79	81		15.4	98	97		15.6	99	128		14.0	97	99	
5	2	7		7		2	74	1	0	2	0	0	0	0	0	0	3	103	83		16.1	112	117		15.8	110	127		15.4	118	99	
1	3	8		8		3	74	0	0	3	16	0	30	0	0	0	49	68	95	148	15.4	79	116	159	15.0	82	110	142	14.4	84	99	123
2	3	10		10		3	81	0	0	2	16	0	12	0	0	64	94	77	104	151	15.6	96	135	171	14.7	98	116	155	13.4	96	113	128
3	3	9		9		3	63	0	0	5	24	0	36	0	0	32	97	69	114	145	16.6	85	123	142	15.4	93	133	148	13.6	93	105	128
4	3	6		6		3	71	0	0	22	24	18	48	0	0	64	176	73	114	156	16.0	89	132	150	15.2	94	129	150	13.4	97	104	134
5	3	1		1		3	68	0	0	0	0	0	18	0	0	0	18	68	115	147	10.8	81	122	143	10.4	86	118	144	10.2	88	97	117
6	3	1	6	1	6	3	74	0	0	6	0	0	6	16	0	96	124	77	123	147	14.4	92	131	159	12.5	95	128	153	11.8	96	107	143
1	4	5		5		2	74	0	0	0	0	0	0	0	0	0	0	90	186	106	9.2	103	221	134	9.1	88	149	133	8.9	95	124	91
2	4	6		6		2	79	0	0	4	0	36	12	0	0	0	52	87	208	127	15.7	91	191	135	15.5	91	148	145	14.2			
3	4	8		8		2	76	0	0	1	0	12	0	8	0	0	21	101	165	114	15.5	101	165	114	14.7	88	138	125	14.5	96	128	93
4	4	10		10		2	79	0	0	1	0	12	6	0	0	64	83	80	167	109	15.3	83	192	128	14.8	81	139	125	14.4			
5	4	9		9		2	58	0	0	2	0	36	0	0	0	0	38	70	98		16.5	68	90	119	16.4	65	150	133	15.9	83	129	81
6	4	7		7		2	79	1	0	13	0	186	0	0	0	0	200	77	210	121	16.0	83	156	132	15.7	86	164	144	14.1	105	164	106
7	4	6		6		2	71	0	0	2	0	30	0	0	0	0	32	76	203	111	16.0	87	180	122	15.7	93	148	140	13.7	95	139	94
8	4	1		1		2	66	0	0	0	0	24	0	0	0	0	24	70	191	90	10.8	84	190	107	10.7	91	132	137	10.4	89	124	87
9	4	1	6	1	6	2	74	0	0	0	0	84	0	0	0	0	84	80	211	112	12.9	90	173	120	12.5	96	145	143	12.9	94	141	96

SUMMARY OF VOLATILITY RUNS - INTERMEDIATE TEMPERATURE

										IDLE DEM		DRIVING DEM																				
RUN	VEHICLE	IFUEL1	IFUEL2	RFUEL1	RFUEL2	DRIVER	TEMP	INTSTART	RESTART	ROUGH	STALL	HESITATION	STUMBLE	SURGE	BACKFIRE	STALL	TWD	TANK1	UNDERHOOD1	CARBURETOR1	RVP1	TANK2	UNDERHOOD2	CARBURETOR2	RVP2	TANK3	UNDERHOOD3	CARBURETOR3	RVP3	TANK4	UNDERHOOD4	CARBURETOR4
1	5	6		6		4	75	0	0	0	0	0	0	0	0	0	0	76	93		15.7	90	105		15.4	96	126		13.6	98	105	
2	5	8		8		4	77	0	0	0	0	0	0	0	0	0	0	76	92		14.9	92	107		14.0	97	120		14.0	98	103	
3	5	10		10		4	76	0	0	0	0	0	6	4	0	0	10	76	91		15.0	84	102		14.9	87	104		13.8	90	96	
4	5	9		9		4	83	0	0	0	0	0	6	0	0	0	6	76	93		16.3	89	108		15.3	94	112		12.8	97	102	
5	5	7		7		4	74	0	0	1	0	0	18	0	0	0	19	80	95		16.0	90	105		15.1	98	131		12.7	100	104	
1	6	5		5		3	78	0	0	0	0	0	0	0	0	0	0	81	96		9.1	96	110		9.1	100	134		8.9			
2	6	6		6		3	77	0	0	6	8	0	6	8	0	0	28	82	96		15.7	97	108		15.3	101	135		12.9	104	108	
3	6	8		8		3	74	0	0	4	8	0	0	0	0	0	12	79	93		15.3	91	103		14.9	95	116		13.6	95	99	
4	6	10		10		3	79	0	0	1	0	0	0	0	0	0	1	75	88		15.1	90	101		14.7	92	106			92	97	
5	6	9		9		3	58	0	0	1	0	0	0	0	0	0	1	66	79		16.4	78	90		16.2	86	125		15.3	89	94	
6	6	7		7		3	79	0	0	9	0	0	0	0	0	0	9	80	94		16.0	98	107		15.4	102	129		13.3	104	108	
7	6	6		6		3	75	0	0	9	0	0	0	0	0	0	9				15.9	96	107		15.2	88	108		13.2	92	96	
8	6	1		1		3	71	0	0	4	0	0	0	0	0	0	4				10.7	91	104		10.5	100	130		10.2	97	102	
1	7	8		8		2	74	0	0	0	8	0	12	0	0	0	20	68	72	113		76	81	139		83	97	128	14.9	84	85	
2	7	10		10		2	81	0	0	0	0	0	0	0	0	0	0	78	94	137	15.3	91	101	140	15.0	95	113	136	14.6	94	100	
3	7	9		9		2	62	0	0	2	0	6	0	0	0	0	8	66	86	125	16.3	78	94	137	15.7	93	126	133	15.2	92	96	107
4	7	6		6		2	75	0	0	0	8	24	0	0	0	0	32	76	101	128	15.9	86	99	129	15.5	94	124	137	14.1	94	97	108
5	7	1		1		2	71	0	0	0	0	18	0	0	0	0	18	71	78	122	10.9	87	89	144	10.6	85	119	138	10.2	86	89	102
1	8	5		5		1	74	0	0	16	0	0	0	0	0	0	16	78	112		9.2	93	113		9.1	98	134		9.0	99	111	
2	8	6		6		1	77	0	0	2	0	0	6	0	0	0	8				15.4	98	118		15.1	103	148		13.2	105	118	
3	8	8		8		1	75	0	0	3	0	6	6	0	0	0	15	78	108		15.4	90	111		15.1	95	129		14.0	96	109	
4	8	10		10		1	76	0	0	12	0	0	0	0	0	0	12	81	120		15.2	91	116		14.8	90	134		14.2	92	110	
5	8	9		9		1	83	0	0	4	0	0	0	4	0	0	8	85	125		16.2	98	120		15.6	96	145		13.9	98	115	
6	8	7		7		1	79	0	0	2	8	0	42	4	0	0	56	85	128		15.9	100	125		15.3	107	155		13.2	108	123	
1	9	6		6		3	74	0	0	12	0	6	84	8	0	0	110	75	81		15.6	81	101		15.6	93	111		14.1	95	102	
[illegible]	9	8		8		3	76	0	0	7	0	0	18	0	0	0	25	76	80		15.0	85	99		14.8	90	97		14.3	87	96	
3	9	10		10		3	83	0	0	7	0	0	18	0	0	0	25	79	83		15.8	84	99		15.2	91	103		14.0	92	99	
4	9	7		7		3	76	0	0	12	0	0	12	0	0	0	24	76	82		16.0	87	101		15.8	102	120		14.2	102	107	

SUMMARY OF VOLATILITY RUNS - INTERMEDIATE TEMPERATURE

										IDLE DEM		DRIVING DEM																				
RUN	VEHICLE	IFUEL1	IFUEL2	RFUEL1	RFUEL2	DRIVER	TEMP	INTSTART	RESTART	ROUGH	STALL	HESITATION	STUMBLE	SURGE	BACKFIRE	STALL	TWD	TANK1	UNDERHOOD1	CARBURETOR1	RVP1	TANK2	UNDERHOOD2	CARBURETOR2	RVP2	TANK3	UNDERHOOD3	CARBURETOR3	RVP3	TANK4	UNDERHOOD4	CARBURETOR4
1	10	6		6		1	74	1	0	0	8	0	0	0	0	0	9	80	118		12.8	85	130		14.1	87	126		13.8	89	115	
2	10	8		8		1	77	2	0	3	0	6	0	8	0	0	19	75	114		15.4	81	118		15.3	89	112		13.9	90	102	
3	10	10		10		1	83	1	0	0	8	0	0	4	0	0	13	76	115		15.3	87	116		14.9	84	135		14.5	87	109	
4	10	9		9		1	59	0	0	0	16	0	0	12	0	0	28	63	108	108	16.5	69	119	114	16.3	73	123	138	16.0	75	108	107
5	10	7		7		1	74	0	0	0	0	0	6	24	0	0	30	78	119	123	16.3	89	127	134	16.1	90	130	145	15.0	93	103	121
6	10	1		1		1	71	0	0	0	0	0	0	4	0	0	4	73	125	126	10.5	84	154	131	11.0	81	110	142	10.2	92	112	104
7	10	6		6		1	71	0	0	0	8	0	0	8	0	0	16	75	117	118	16.0	82	128	133	15.7	81	123	142	14.6	93	99	121
1	11	8		8		4	74	1	0	0	0	36	42	12	0	0	91	68	77	127	15.3	78	89	153	15.2	80	115	127	15.3	81	89	129
2	11	10		10		4	83	1	0	0	0	0	36	4	0	0	41	80	93	150	15.3	90	100	170	15.3	92	126	142	14.7	93	97	144
3	11	9		9		4	62	2	0	0	0	42	66	12	0	32	154	69	89	125	16.1	78	93	149	15.9	85	128	134	15.4	87	90	128
4	11	1		1		4	69	0	0	2	0	48	78	4	0	0	132	68	82	130	11.6	80	92	153	11.5	86	110	128	11.3	87	88	116
5	11	1	6	1	6	4	72	1	0	1	0	12	54	20	6	0	94	82	101	144		93	109	156	13.0	98	127	141	12.5	99	100	129
6	11	6		6		4	71	2	0	1	0	6	96	12	0	0	117	75	90	135	16.0	87	101	150	15.9	93	124	134	14.8	93	96	131
1	13	8		8		1	76	0	0	0	0	0	0	0	0	0	0	93	97		14.7	98	102		14.2	83	105		14.2	95	104	
2	13	10		10		1	79	0	0	0	0	0	0	0	0	0	0	95	100		14.8	102	106		13.2	102	107		13.4	102	110	
3	13	9		9		1	61	0	0	1	0	0	0	0	0	0	1	93	101		15.1	106	110		13.8	91	131		13.2	104	114	
4	13	6		6		1	75	0	0	0	24	0	0	4	0	0	28	100	107		15.7	110	116		14.9	94	123		13.1	109	118	
5	13	1		1		1	69	0	0	0	8	0	0	0	0	0	8				11.3	111	116		11.4	87	122		11.3	106	113	
6	13	1	6	1	6	1	74	0	0	0	8	0	0	0	0	0	8	105	108		12.1	113	118		11.5	98	122		11.8	114	120	

APPENDIX G

DATA SETS AND MODELS FOR ANALYSIS OF VARIANCE AND REGRESSION

APPENDIX G

Temperature Effect (Regression Only)

```
Data Set: Four Fuels at Both Temperature Levels
Class Fuel Car;
Model SRTWD=Temperature Fuel Car Temperature*Car
     Fuel*Car / Solution;
```

Fuel System Effects

```
Data Sets: All High Temperature Data, or Four Fuels at Medium
     Temperature
Class Fuel System Car;
Model SRTWD=Fuel System Car(System) Fuel*System Fuel*Car(System);
Contrast 'MPI - Carb' System -1 1 0;
Contrast 'TBI - Carb' System -1 0 1;
Contrast 'TBI - MPI' System  0 -1 1;
Lsmeans System / Stderr;
```

Fuel Comparisons

```
Data Sets: All High Temperature Data, or Four Fuels at Medium
     Temperature
Class Fuel Car;
Model SRTWD=Fuel Car Fuel*Car;
Contrast 'Meoh Adj - Low Base' -1 1 0 0 0 0 0 0 0 0; for example
Other contrast statements as needed.
Lsmeans Fuel / Stderr;
```

Volatility Level

```
Data Set: All High Temperature Data
Class Volatility Fuel Car;
Model SRTWD=Volatility Fuel(Volatility) Car Volatility*Car
     Fuel(Volatility)*Car;
Test H=Volatility E=Volatility*Car;
Lsmeans Volatility / Stderr;
```

Volatility Adjustment

```
Data Sets: All High Temperature Data, or Four Fuels at Medium
     Temperatures
Class Adjust Fuel Car;
Model SRTWD=Adjust Fuel(Adjust) Car Adjust*Car Fuel(Adjust)*Car;
```

```
Test H=Adjust E=Adjust*Car;
Lsmeans Adjust / Stderr;
```

Alcohol Effects

```
Data Sets: All High Temperature Data, or Four Fuels at Medium
     Temperatures
Class Alcohol Fuel Car;
Model SRTWD=Alcohol Fuel(Alcohol) Car Alcohol*Car Fuel(Alcohol)*Car;
Test H=Alcohol E=Alcohol*Car;
Lsmeans Alcohol / Stderr;
```

Notes - All but the first two analyses listed above were done for each fuel delivery system as well as for the overall 12-vehicle fleet. The "Lsmeans" statements were not actually used, but they are the best method for obtaining averages for subgroupings of the data.

```
CMS FI 12 DISK SAS LISTING T;
CMS FILEDEF ALL DISK CRC1985 DATA A;
OPTIONS MACROGEN;
TITLE1 '1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM';
DATA ALL;     COMMENT - EST. 45 TWD FOR FUEL9 IN CAR9 AT MEDIUM TEMP.;
INFILE ALL;
  LENGTH TEMPLEV $ 6 SYSTEM $ 4 VOL $ 6 ALCOHOL $ 4 ADJUST $ 6;
  INPUT DRIVER CAR RUN FUEL  RVP TVL20 TEMP TEMPLEV $ TWD;
  SRTWD=TWD**0.5;        IF CAR=12 THEN DELETE;
  SYSTEM='CARB'; IF CAR=2 OR CAR=8 OR CAR=9 THEN SYSTEM='TBI';
  IF CAR=5 OR CAR=6 OR CAR=13 THEN SYSTEM='PFI';
  VOL='MEDIUM'; IF FUEL LT 6 THEN VOL='LOW';
  ALCOHOL='OXY'; IF FUEL=1 OR FUEL=6 THEN ALCOHOL='BASE';
  IF FUEL=4 OR FUEL=5 OR FUEL=9 OR FUEL=10 THEN ALCOHOL='ETOH';
  ADJUST='MATCH'; IF FUEL=1 OR FUEL=6 THEN ADJUST='BASE';
  IF FUEL=3 OR FUEL=5 OR FUEL=8 OR FUEL=10 THEN ADJUST='SPLASH';
CARDS;
DATA HOT; SET ALL; IF TEMPLEV='HIGH'; IF FUEL LT 11;
DATA HOT4; SET HOT; IF FUEL=6 OR FUEL=8 OR FUEL=9 OR FUEL=10;
DATA MED; SET ALL; IF TEMPLEV='MEDIUM'; IF FUEL LT 11;
DATA MED4; SET MED; IF FUEL=6 OR FUEL=8 OR FUEL=9 OR FUEL=10;
DATA BOTH4; SET HOT4 MED4;
PROC SORT DATA=HOT; BY SYSTEM;
PROC SORT DATA=MED4; BY SYSTEM;
MACRO ANAL1     COMMENT - THIS EVALUATES TEMPERATURE LEVEL.;
PROC SORT DATA=BOTH4; BY SYSTEM;
PROC GLM DATA=BOTH4;
  TITLE2 'EVALUATING TEMPERATURE LEVEL';
  CLASS FUEL TEMPLEV CAR;
  MODEL SRTWD=FUEL TEMPLEV CAR FUEL*TEMPLEV FUEL*CAR TEMPLEV*CAR;
  TEST H=TEMPLEV E=TEMPLEV*CAR; TEST H=FUEL E=FUEL*CAR;
  CONTRAST 'HIGH VS MEDIUM' TEMPLEV 1 -1 / E=TEMPLEV*CAR;
PROC GLM DATA=BOTH4; BY SYSTEM;
  CLASS FUEL TEMPLEV CAR;
  MODEL SRTWD=FUEL TEMPLEV CAR FUEL*TEMPLEV FUEL*CAR TEMPLEV*CAR;
  TEST H=TEMPLEV E=TEMPLEV*CAR; TEST H=FUEL E=FUEL*CAR;
  CONTRAST 'HIGH VS MEDIUM' TEMPLEV 1 -1 / E=TEMPLEV*CAR;
%
MACRO ANAL2     COMMENT - THIS EVALUATES TEMPERATURE EFFECTS.;
PROC GLM DATA=BOTH4;
  TITLE2 'EVALUATING TEMPERATURE EFFECTS';
  CLASS FUEL CAR;
  MODEL TWD=TEMP FUEL CAR TEMP*FUEL TEMP*CAR FUEL*CAR / SOLUTION;
%
MACRO ANAL3     COMMENT - THIS COMPARES FUEL SYSTEMS.;
PROC GLM DATA=HOT;
  TITLE2 'EVALUATING FUEL SYSTEMS';
  TITLE3 'HIGH TEMPERATURE DATA';
  CLASS FUEL SYSTEM CAR;
  MODEL SRTWD=FUEL SYSTEM CAR(SYSTEM) FUEL*SYSTEM FUEL*CAR(SYSTEM);
  TEST H=FUEL E=FUEL*CAR(SYSTEM); TEST H=SYSTEM E=CAR(SYSTEM);
  LSMEANS SYSTEM / STDERR;
  CONTRAST 'PFI - CARB' SYSTEM -1 1 0 / E=CAR(SYSTEM);
  CONTRAST 'TBI - CARB' SYSTEM -1 0 1 / E=CAR(SYSTEM);
  CONTRAST 'TBI - PFI' SYSTEM 0 -1 1 / E=CAR(SYSTEM);
```

```
PROC GLM DATA=MED4;
  TITLE3 'MEDIUM TEMPERATURE DATA';
  CLASS FUEL SYSTEM CAR;
  MODEL SRTWD=FUEL SYSTEM CAR(SYSTEM) FUEL*SYSTEM FUEL*CAR(SYSTEM);
  TEST H=FUEL E=FUEL*CAR(SYSTEM); TEST H=SYSTEM E=CAR(SYSTEM);
  LSMEANS SYSTEM / STDERR;
  CONTRAST 'PFI - CARB' SYSTEM -1 1 0 / E=CAR(SYSTEM);
  CONTRAST 'TBI - CARB' SYSTEM -1 0 1 / E=CAR(SYSTEM);
  CONTRAST 'TBI - PFI' SYSTEM 0 -1 1 / E=CAR(SYSTEM);
%
MACRO ANAL4     COMMENT - THIS MAKES TWO-FUEL COMPARISONS.;
PROC GLM DATA=HOT;
  TITLE2 'FUEL COMPARISONS';
  TITLE3 'HIGH TEMPERATURE DATA';
  CLASS FUEL CAR;
  MODEL SRTWD=FUEL CAR FUEL*CAR;
  TEST H=FUEL E=FUEL*CAR;
  CONTRAST 'MEOH MAT - LOW BASE' FUEL -1 1 0 0 0 0 0 0 0 0 / E=FUEL*CAR;
  CONTRAST 'MEOH SPL - LOW BASE' FUEL -1 0 1 0 0 0 0 0 0 0 / E=FUEL*CAR;
  CONTRAST 'ETOH MAT - LOW BASE' FUEL -1 0 0 1 0 0 0 0 0 0 / E=FUEL*CAR;
  CONTRAST 'ETOH SPL - LOW BASE' FUEL -1 0 0 0 1 0 0 0 0 0 / E=FUEL*CAR;
  CONTRAST 'MEOH MAT - MED BASE' FUEL 0 0 0 0 0 -1 1 0 0 0 / E=FUEL*CAR;
  CONTRAST 'MEOH SPL - MED BASE' FUEL  0 0 0 0 0 -1 0 1 0 0 / E=FUEL*CAR;
  CONTRAST 'ETOH MAT - MED BASE' FUEL 0 0 0 0 0 -1 0 0 1 0 / E=FUEL*CAR;
  CONTRAST 'ETOH SPL - MED BASE' FUEL 0 0 0 0 0 -1 0 0 0 1 / E=FUEL*CAR;

  CONTRAST 'ETOH SP - MEOH LOW' FUEL   0 0 -1 0 1 0 0 0 0 0 / E=FUEL*CAR;
  CONTRAST 'ETOH MAT - MEOH LOW' FUEL  0 -1 0 1 0 0 0 0 0 0 / E=FUEL*CAR;
  CONTRAST 'ETOH SP - MEOH MED' FUEL 0 0 0 0 0 0 0 -1 0 1 / E=FUEL*CAR;
  CONTRAST 'ETOH MAT - MEOH MED' FUEL  0 0 0 0 0 0 -1 0 1 0 / E=FUEL*CAR;

  CONTRAST 'MEOH SP - MAT LOW' FUEL 0 -1 1 0 0 0 0 0 0 0 / E=FUEL*CAR;
  CONTRAST 'ETOH SP - MAT LOW' FUEL 0 0 0 -1 1 0 0 0 0 0 / E=FUEL*CAR;
  CONTRAST 'MEOH SP - MAT MED' FUEL 0 0 0 0 0 0 -1 1 0 0 / E=FUEL*CAR;
  CONTRAST 'ETOH SP - MAT MED' FUEL 0 0 0 0 0  0 0 0 -1 1 / E=FUEL*CAR;
  LSMEANS FUEL / STDERR;
PROC GLM DATA=HOT; BY SYSTEM;
  TITLE2 'FUEL COMPARISONS USING THE SQUARE ROOT OF TWD';
  TITLE3 'HIGH TEMPERATURE DATA';
  CLASS FUEL CAR;
  MODEL SRTWD=FUEL CAR FUEL*CAR;
  TEST H=FUEL E=FUEL*CAR;
  CONTRAST 'MEOH MAT - LOW BASE' FUEL -1 1 0 0 0 0 0 0 0 0 / E=FUEL*CAR;
  CONTRAST 'MEOH SPL - LOW BASE' FUEL -1 0 1 0 0 0 0 0 0 0 / E=FUEL*CAR;
  CONTRAST 'ETOH MAT - LOW BASE' FUEL -1 0 0 1 0 0 0 0 0 0 / E=FUEL*CAR;
  CONTRAST 'ETOH SPL - LOW BASE' FUEL -1 0 0 0 1 0 0 0 0 0 / E=FUEL*CAR;
  CONTRAST 'MEOH MAT - MED BASE' FUEL 0 0 0 0 0 -1 1 0 0 0 / E=FUEL*CAR;
  CONTRAST 'MEOH SPL - MED BASE' FUEL  0 0 0 0 0 -1 0 1 0 0 / E=FUEL*CAR;
  CONTRAST 'ETOH MAT - MED BASE' FUEL 0 0 0 0 0 -1 0 0 1 0 / E=FUEL*CAR;
  CONTRAST 'ETOH SPL - MED BASE' FUEL 0 0 0 0 0 -1 0 0 0 1 / E=FUEL*CAR;

  CONTRAST 'ETOH SP - MEOH LOW' FUEL   0 0 -1 0 1 0 0 0 0 0 / E=FUEL*CAR;
  CONTRAST 'ETOH MAT - MEOH LOW' FUEL  0 -1 0 1 0 0 0 0 0 0 / E=FUEL*CAR;
  CONTRAST 'ETOH SP - MEOH MED' FUEL 0 0 0 0 0 0 0 -1 0 1 / E=FUEL*CAR;
  CONTRAST 'ETOH MAT - MEOH MED' FUEL  0 0 0 0 0 0 -1 0 1 0 / E=FUEL*CAR;
```

```
  CONTRAST 'MEOH SP - MAT LOW' FUEL 0 -1 1 0 0 0 0 0 0 0 / E=FUEL*CAR;
  CONTRAST 'ETOH SP - MAT LOW' FUEL 0 0 0 -1 1 0 0 0 0 0 / E=FUEL*CAR;
  CONTRAST 'MEOH SP - MAT MED' FUEL 0 0 0 0 0 0 -1 1 0 0 / E=FUEL*CAR;
  CONTRAST 'ETOH SP - MAT MED' FUEL 0 0 0 0 0  0 0 0 -1 1 / E=FUEL*CAR;
  LSMEANS FUEL / STDERR;
PROC GLM DATA=MED4;
  TITLE3 'MEDIUM TEMPERATURE DATA';
  CLASS FUEL CAR;
  MODEL SRTWD=FUEL CAR FUEL*CAR;
  TEST H=FUEL E=FUEL*CAR;
  CONTRAST 'MEOH SPL - MED BASE' FUEL -1 1 0 0 / E=FUEL*CAR;
  CONTRAST 'ETOH MAT - MED BASE' FUEL -1 0 1 0 / E=FUEL*CAR;
  CONTRAST 'ETOH SPL - MED BASE' FUEL -1 0 0 1 / E=FUEL*CAR;
  CONTRAST 'ETOH SPL - ETOH MAT' FUEL 0 0 -1 1 / E=FUEL*CAR;
  LSMEANS FUEL / STDERR;
PROC GLM DATA=MED4; BY SYSTEM;
  TITLE2 'FUEL COMPARISONS USING THE SQUAREROOT OF TWD';
  TITLE3 'MEDIUM TEMPERATURE DATA';
  CLASS FUEL CAR;
  MODEL SRTWD=FUEL CAR FUEL*CAR;
  TEST H=FUEL E=FUEL*CAR;
  CONTRAST 'MEOH SPL - MED BASE' FUEL -1 1 0 0 / E=FUEL*CAR;
  CONTRAST 'ETOH MAT - MED BASE' FUEL -1 0 1 0 / E=FUEL*CAR;
  CONTRAST 'ETOH SPL - MED BASE' FUEL -1 0 0 1 / E=FUEL*CAR;
  CONTRAST 'ETOH SPL - ETOH MAT' FUEL 0 0 -1 1 / E=FUEL*CAR;
  LSMEANS FUEL / STDERR;
%
MACRO ANAL5    COMMENT - THIS EVALUATES VOLATILITY LEVEL.;
PROC GLM DATA=HOT;
  TITLE2 'EVALUATING VOLATILITY LEVEL';
  TITLE3 'HIGH TEMPERATURE DATA';
  CLASS VOL FUEL CAR;
  MODEL SRTWD=VOL FUEL(VOL) CAR VOL*CAR CAR*FUEL(VOL);
  TEST H=VOL E=VOL*CAR; TEST H=FUEL(VOL) E=CAR*FUEL(VOL);
  CONTRAST 'MEDIUM - LOW' VOL -1 1 / E=VOL*CAR;
  LSMEANS VOL / STDERR;
PROC GLM DATA=HOT; BY SYSTEM;
  CLASS VOL FUEL CAR;
  MODEL SRTWD=VOL FUEL(VOL) CAR VOL*CAR CAR*FUEL(VOL);
  TEST H=VOL E=VOL*CAR; TEST H=FUEL(VOL) E=CAR*FUEL(VOL);
  CONTRAST 'MEDIUM - LOW' VOL -1 1 / E=VOL*CAR;
  LSMEANS VOL / STDERR;
%
MACRO ANAL6    COMMENT - THIS EVALUATES TYPE OF VOLATILITY ADJUSTMENT.;
PROC GLM DATA=HOT;
  TITLE 'EVALUATING TYPE OF VOLATILITY ADJUSTMENT';
  TITLE3 'HIGH TEMPERATURE DATA';
  CLASS ADJUST FUEL CAR;
  MODEL SRTWD=ADJUST FUEL(ADJUST) CAR ADJUST*CAR CAR*FUEL(ADJUST);
  TEST H=ADJUST E=ADJUST*CAR; TEST H=FUEL(ADJUST) E=CAR*FUEL(ADJUST);
  CONTRAST 'MATCH - MED BASE' ADJUST -1 1 0 / E=ADJUST*CAR;
  CONTRAST 'SPLASH - MED BASE' ADJUST -1 0 1 / E=ADJUST*CAR;
  CONTRAST 'SPLASH - MATCH' ADJUST 0 -1 1 / E=ADJUST*CAR;
  LSMEANS ADJUST / STDERR;
```

```
PROC GLM DATA=HOT; BY SYSTEM;
  CLASS ADJUST FUEL CAR;
  MODEL SRTWD=ADJUST FUEL(ADJUST) CAR ADJUST*CAR CAR*FUEL(ADJUST);
  TEST H=ADJUST E=ADJUST*CAR; TEST H=FUEL(ADJUST) E=CAR*FUEL(ADJUST);
  CONTRAST 'MATCH - MED BASE' ADJUST -1 1 0 / E=ADJUST*CAR;
  CONTRAST 'SPLASH - MED BASE' ADJUST -1 0 1 / E=ADJUST*CAR;
  CONTRAST 'SPLASH - MATCH' ADJUST 0 -1 1 / E=ADJUST*CAR;
  LSMEANS ADJUST / STDERR;
PROC GLM DATA=MED4;
  TITLE3 'MEDIUM TEMPERATURE DATA';
  CLASS ADJUST FUEL CAR;
  MODEL SRTWD=ADJUST FUEL(ADJUST) CAR ADJUST*CAR CAR*FUEL(ADJUST);
  TEST H=ADJUST E=ADJUST*CAR; TEST H=FUEL(ADJUST) E=CAR*FUEL(ADJUST);
  CONTRAST 'MATCH - MED BASE' ADJUST -1 1 0 / E=ADJUST*CAR;
  CONTRAST 'SPLASH - MED BASE' ADJUST -1 0 1 / E=ADJUST*CAR;
  CONTRAST 'SPLASH - MATCH' ADJUST 0 -1 1 / E=ADJUST*CAR;
  LSMEANS ADJUST / STDERR;
PROC GLM DATA=MED4; BY SYSTEM;
  CLASS ADJUST FUEL CAR;
  MODEL SRTWD=ADJUST FUEL(ADJUST) CAR ADJUST*CAR CAR*FUEL(ADJUST);
  TEST H=ADJUST E=ADJUST*CAR; TEST H=FUEL(ADJUST) E=CAR*FUEL(ADJUST);
  CONTRAST 'MATCH - MED BASE' ADJUST -1 1 0 / E=ADJUST*CAR;
  CONTRAST 'SPLASH - MED BASE' ADJUST -1 0 1 / E=ADJUST*CAR;
  CONTRAST 'SPLASH - MATCH' ADJUST 0 -1 1 / E=ADJUST*CAR;
  LSMEANS ADJUST / STDERR;
%
MACRO ANAL7     COMMENT - THIS EVALUATES TYPE OF ALCOHOL.;
PROC GLM DATA=HOT;
  TITLE2 'EVALUATING TYPE OF ALCOHOL';
  TITLE3 'HIGH TEMPERATURE DATA';
  CLASS ALCOHOL FUEL CAR;
  MODEL SRTWD=ALCOHOL FUEL(ALCOHOL) CAR ALCOHOL*CAR CAR*FUEL(ALCOHOL);
  TEST H=ALCOHOL E=ALCOHOL*CAR; TEST H=FUEL(ALCOHOL) E=CAR*FUEL(ALCOHOL);
  CONTRAST 'ETHANOL - BASE' ALCOHOL -1 1 0 / E=ALCOHOL*CAR;
  CONTRAST 'OXINOL - BASE' ALCOHOL -1 0 1 / E=ALCOHOL*CAR;
  CONTRAST 'OXINOL - ETHANOL' ALCOHOL 0 -1 1 / E=ALCOHOL*CAR;
  LSMEANS ALCOHOL / STDERR;
PROC GLM DATA=HOT; BY SYSTEM;
  CLASS ALCOHOL FUEL CAR;
  MODEL SRTWD=ALCOHOL FUEL(ALCOHOL) CAR ALCOHOL*CAR CAR*FUEL(ALCOHOL);
  TEST H=ALCOHOL E=ALCOHOL*CAR; TEST H=FUEL(ALCOHOL) E=CAR*FUEL(ALCOHOL);
  CONTRAST 'ETHANOL - BASE' ALCOHOL -1 1 0 / E=ALCOHOL*CAR;
  CONTRAST 'OXINOL - BASE' ALCOHOL -1 0 1 / E=ALCOHOL*CAR;
  CONTRAST 'OXINOL - ETHANOL' ALCOHOL 0 -1 1 / E=ALCOHOL*CAR;
  LSMEANS ALCOHOL / STDERR;
PROC GLM DATA=MED4;
  TITLE3 'MEDIUM TEMPERATURE DATA';
  CLASS ALCOHOL FUEL CAR;
  MODEL SRTWD=ALCOHOL FUEL(ALCOHOL) CAR ALCOHOL*CAR CAR*FUEL(ALCOHOL);
  TEST H=ALCOHOL E=ALCOHOL*CAR; TEST H=FUEL(ALCOHOL) E=CAR*FUEL(ALCOHOL);
  CONTRAST 'ETHANOL - BASE' ALCOHOL -1 1 0 / E=ALCOHOL*CAR;
  CONTRAST 'OXINOL - BASE' ALCOHOL -1 0 1 / E=ALCOHOL*CAR;
  CONTRAST 'OXINOL - ETHANOL' ALCOHOL 0 -1 1 / E=ALCOHOL*CAR;
  LSMEANS ALCOHOL / STDERR;
PROC GLM DATA=MED4; BY SYSTEM;
```

```
   CLASS ALCOHOL FUEL CAR;
   MODEL SRTWD=ALCOHOL FUEL(ALCOHOL) CAR ALCOHOL*CAR CAR*FUEL(ALCOHOL);
   TEST H=ALCOHOL E=ALCOHOL*CAR; TEST H=FUEL(ALCOHOL) E=CAR*FUEL(ALCOHOL);
   CONTRAST 'ETHANOL - BASE' ALCOHOL -1 1 0 / E=ALCOHOL*CAR;
   CONTRAST 'OXINOL - BASE' ALCOHOL -1 0 1 / E=ALCOHOL*CAR;
   CONTRAST 'OXINOL - ETHANOL' ALCOHOL 0 -1 1 / E=ALCOHOL*CAR;
   LSMEANS ALCOHOL / STDERR;
%

ANAL1
ANAL2
ANAL3
ANAL4
ANAL5
ANAL6
ANAL7
PROC SORT DATA=ALL; BY TEMPLEV FUEL SYSTEM CAR;
PROC PRINT;
TITLE1 '1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM';
TITLE2 'ALL DATA SORTED BY TEMP BY FUEL BY SYSTEM BY CAR';
TITLE3 '   ';
PROC MEANS NOPRINT DATA=ALL;
VAR TWD SRTWD;
BY TEMPLEV FUEL SYSTEM CAR;
OUTPUT OUT=AVE MEAN=TWDM SRTWDM;
TITLE2 'AVERAGE TWD FOR EACH CAR BY TEMP BY FUEL BY SYSTEM';
PROC PRINT DATA=AVE;
PROC SORT DATA=AVE; BY TEMPLEV FUEL SYSTEM;
PROC MEANS  DATA=AVE; BY TEMPLEV FUEL SYSTEM;
VAR TWDM SRTWDM ;
TITLE2 'AVERAGE TWD BY TEMP BY FUEL BY SYSTEM';
PROC MEANS  DATA=AVE; BY TEMPLEV FUEL ;
VAR TWDM SRTWDM;
TITLE2 'AVERAGE TWD FOR ALL CARS BY TEMP BY FUEL';
```

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING TEMPERATURE LEVEL

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
FUEL	4	6 8 9 10
TEMPLEV	2	HIGH MEDIUM
CAR	12	1 2 3 4 5 6 7 8 9 10 11 13

NUMBER OF OBSERVATIONS IN DATA SET = 132

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING TEMPERATURE LEVEL

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	62	2900.09408137	46.77571099	15.68	66E-25	0.933713	23.9860
ERROR	69	205.88759070	2.98387813		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	131	3105.98167207			1.72739055		7.20165087

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
FUEL	3	19.59484318	2.19	0.0971	3	25.57168050	2.86	0.0433
TEMPLEV	1	360.40260470	120.81	82E-18	1	255.80226460	85.73	10E-14
CAR	11	2054.06008209	62.58	19E-32	11	1805.34843413	55.00	99E-31
FUEL*TEMPLEV	3	13.75040573	1.54	0.2127	3	20.12121091	2.25	0.0905
FUEL*CAR	33	212.64198885	2.16	0.0036	33	213.95110637	2.17	0.0034
TEMPLEV*CAR	11	239.54506682	7.30	42E-9	11	239.54506682	7.30	42E-9

TESTS OF HYPOTHESES USING THE TYPE III MS FOR TEMPLEV*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
TEMPLEV	1	255.80226460	11.75	0.0056

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL	3	25.57168050	1.31	0.2861

TESTS OF HYPOTHESES USING THE TYPE III MS FOR TEMPLEV*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
HIGH VS MEDIUM	1	255.80226460	11.75	0.0056

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING TEMPERATURE LEVEL

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
FUEL	4	6 8 9 10
TEMPLEV	2	HIGH MEDIUM
CAR	6	1 3 4 7 10 11

NUMBER OF OBSERVATIONS IN BY GROUP = 72

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING TEMPERATURE LEVEL

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	32	1163.93004736	36.37281398	11.16	13E-12	0.901557	18.0383
ERROR	39	127.00141516	3.25875423		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	71	1291.02146252			1.80520199		10.00762108

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
FUEL	3	11.98743527	1.23	0.3131	3	31.79554160	3.25	0.0318
TEMPLEV	1	319.46816280	98.03	34E-13	1	300.87701627	92.33	78E-13
CAR	5	549.01303419	33.69	37E-14	5	459.79311941	28.22	56E-13
FUEL*TEMPLEV	3	9.87079647	1.01	0.3988	3	11.94158428	1.22	0.3148
FUEL*CAR	15	119.96093121	2.45	0.0124	15	118.15028127	2.42	0.0137
TEMPLEV*CAR	5	153.62278742	9.43	595E-8	5	153.62278742	9.43	595E-8

TESTS OF HYPOTHESES USING THE TYPE III MS FOR TEMPLEV*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
TEMPLEV	1	300.87701627	9.79	0.0260

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL	3	31.79554160	1.35	0.2971

TESTS OF HYPOTHESES USING THE TYPE III MS FOR TEMPLEV*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
HIGH VS MEDIUM	1	300.87701627	9.79	0.0260

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING TEMPERATURE LEVEL

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
FUEL	4	6 8 9 10
TEMPLEV	2	HIGH MEDIUM
CAR	3	5 6 13

NUMBER OF OBSERVATIONS IN BY GROUP = 29

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING TEMPERATURE LEVEL

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	17	131.01929133	7.70701714	6.00	0.0022	0.902617	46.5683
ERROR	11	14.13557332	1.28505212		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	28	145.15486465			1.13360139		2.43427491

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
FUEL	3	1.40452438	0.36	0.7801	3	4.51675092	1.17	0.3646
TEMPLEV	1	5.54730304	4.32	0.0619	1	7.50063036	5.84	0.0342
CAR	2	14.69746728	5.72	0.0198	2	13.09409439	5.09	0.0272
FUEL*TEMPLEV	3	21.52012630	5.58	0.0142	3	21.08667905	5.47	0.0151
FUEL*CAR	6	71.52076456	9.28	0.0009	6	73.10446093	9.48	0.0008
TEMPLEV*CAR	2	16.32901478	6.35	0.0147	2	16.32901478	6.35	0.0147

TESTS OF HYPOTHESES USING THE TYPE III MS FOR TEMPLEV*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
TEMPLEV	1	7.50063036	0.92	0.4387

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL	3	4.51675092	0.12	0.9428

TESTS OF HYPOTHESES USING THE TYPE III MS FOR TEMPLEV*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
HIGH VS MEDIUM	1	7.50063036	0.92	0.4387

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING TEMPERATURE LEVEL

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
FUEL	4	6 8 9 10
TEMPLEV	2	HIGH MEDIUM
CAR	3	2 8 9

NUMBER OF OBSERVATIONS IN BY GROUP = 31

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING TEMPERATURE LEVEL

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	17	267.46012999	15.73294882	4.53	0.0042	0.855594	36.2231
ERROR	13	45.14157359	3.47242874		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	30	312.60170357			1.86344539		5.14436208

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
FUEL	3	9.49065144	0.91	0.4625	3	3.51031284	0.34	0.7989
TEMPLEV	1	41.29947529	11.89	0.0043	1	28.03250845	8.07	0.0139
CAR	2	197.99947055	28.51	176E-7	2	185.79915320	26.75	247E-7
FUEL*TEMPLEV	3	6.58139116	0.63	0.6075	3	6.61198421	0.63	0.6057
FUEL*CAR	6	10.12326128	0.49	0.8076	6	9.83381124	0.47	0.8173
TEMPLEV*CAR	2	1.96588027	0.28	0.7580	2	1.96588027	0.28	0.7580

TESTS OF HYPOTHESES USING THE TYPE III MS FOR TEMPLEV*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
TEMPLEV	1	28.03250845	28.52	0.0333

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL	3	3.51031284	0.71	0.5785

TESTS OF HYPOTHESES USING THE TYPE III MS FOR TEMPLEV*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
HIGH VS MEDIUM	1	28.03250845	28.52	0.0333

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING TEMPERATURE EFFECTS

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
FUEL	4	6 8 9 10
CAR	12	1 2 3 4 5 6 7 8 9 10 11 13

NUMBER OF OBSERVATIONS IN DATA SET = 132

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING TEMPERATURE EFFECTS

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: TWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	62	804788.42466633	12980.45846236	12.46	62E-22	0.918002	42.8113
ERROR	69	71885.09048518	1041.81290558		ROOT MSE		TWD MEAN
CORRECTED TOTAL	131	876673.51515152			32.27712666		75.39393939

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
TEMP	1	62982.61960128	60.45	51E-12	1	66654.90035098	63.98	20E-12
FUEL	3	11730.09482734	3.75	0.0147	3	4474.50248180	1.43	0.2410
CAR	11	538308.06479745	46.97	12E-28	11	65406.61830498	5.71	186E-8
TEMP*FUEL	3	2004.53030532	0.64	0.5910	3	2893.65721177	0.93	0.4330
TEMP*CAR	11	93296.30275777	8.14	65E-10	11	99665.35613461	8.70	20E-10
FUEL*CAR	33	96466.18328716	2.81	0.0002	33	96466.18328716	2.81	0.0002

PARAMETER		ESTIMATE		T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT		-100.01452146	B	-0.80	0.4248	124.57034674
TEMP		1.20499423	B	0.82	0.4169	1.47544201
FUEL	6	128.46869236	B	1.28	0.2035	100.07142709
	8	28.63003653	B	0.28	0.7820	103.07990098
	9	125.22434877	B	1.32	0.1918	94.99135505
	10	0.00000000	B	.	.	.
CAR	1	-196.94630204	B	-1.51	0.1354	130.36429819
	2	20.33130247	B	0.13	0.9004	161.87223674
	3	-589.73044209	B	-4.39	397E-7	134.28355669
	4	-460.77000423	B	-3.58	0.0006	128.64597003
	5	-92.34803993	B	-0.55	0.5851	168.37313584
	6	10.02906896	B	0.08	0.9369	126.12715069
	7	-488.84408650	B	-3.63	0.0005	134.55350503
	8	-91.07965290	B	-0.56	0.5776	162.79268424
	9	-61.48074126	B	-0.39	0.6982	157.87504142
	10	-51.49990781	B	-0.39	0.7005	133.34948317
	11	119.69852880	B	0.88	0.3818	135.99408601
	13	0.00000000	B	.	.	.
TEMP*FUEL	6	-1.38019631	B	-1.21	0.2315	1.14340382
	8	-0.36517676	B	-0.31	0.7559	1.16993164
	9	-1.42060491	B	-1.31	0.1937	1.08248151
	10	0.00000000	B	.	.	.
TEMP*CAR	1	4.16919393	B	2.77	0.0072	1.50490336
	2	-0.23162390	B	-0.12	0.9013	1.86050027
	3	8.15331333	B	5.30	132E-8	1.53864309
	4	6.99176277	B	4.73	117E-7	1.47936403
	5	1.62480299	B	0.83	0.4078	1.95084681
	6	-0.13952567	B	-0.10	0.9238	1.45388314
	7	6.44877535	B	4.19	812E-7	1.53908554
	8	1.55485994	B	0.82	0.4145	1.89396247
	9	1.33709691	B	0.74	0.4637	1.81440063

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING TEMPERATURE EFFECTS

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: TWD

PARAMETER			ESTIMATE		T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
	10		0.72186022	B	0.48	0.6362	1.51921806
	11		-0.71974361	B	-0.46	0.6441	1.55108408
	13		0.00000000	B	.	.	.
FUEL*CAR	6	1	11.74381073	B	0.29	0.7689	39.81598509
	6	2	-11.42574360	B	-0.25	0.8057	46.28160977
	6	3	184.44096218	B	4.38	413E-7	42.10806188
	6	4	-30.94864071	B	-0.77	0.4449	40.27685990
	6	5	-55.89820683	B	-1.21	0.2300	45.98755268
	6	6	1.79652678	B	0.04	0.9650	40.82601352
	6	7	32.13618719	B	0.78	0.4371	41.11472698
	6	8	-24.52509477	B	-0.60	0.5494	40.76590960
	6	9	17.31947421	B	0.41	0.6814	42.00506300
	6	10	-1.25690315	B	-0.03	0.9760	41.50177207
	6	11	40.12779211	B	0.97	0.3362	41.43402815
	6	13	0.00000000	B	.	.	.
	8	1	12.55881016	B	0.31	0.7594	40.84539843
	8	2	3.63158937	B	0.08	0.9346	44.07340488
	8	3	25.45567785	B	0.62	0.5363	40.95464841
	8	4	13.75086874	B	0.33	0.7439	41.92008656
	8	5	-37.93867415	B	-0.86	0.3901	43.80963095
	8	6	13.29650176	B	0.32	0.7520	41.91068317
	8	7	83.06396046	B	1.90	0.0611	43.62613802
	8	8	-24.68876467	B	-0.56	0.5755	43.88016271
	8	9	9.37622784	B	0.22	0.8238	41.94898249
	8	10	16.99568071	B	0.40	0.6888	42.26366894
	8	11	11.15978908	B	0.26	0.7982	43.47143899
	8	13	0.00000000	B	.	.	.
	9	1	12.17131366	B	0.27	0.7881	45.09870435
	9	2	-0.96086979	B	-0.02	0.9836	46.49937087
	9	3	174.78636132	B	3.81	0.0003	45.83482875
	9	4	34.12492220	B	0.74	0.4607	46.00374055
	9	5	-36.66611503	B	-0.79	0.4321	46.39600778
	9	6	-4.60367020	B	-0.10	0.9197	45.47416381
	9	7	63.44741478	B	1.42	0.1608	44.75769147
	9	8	-34.81448518	B	-0.78	0.4365	44.48405133
	9	9	20.68755662	B	0.46	0.6448	44.67892903
	9	10	25.07448845	B	0.54	0.5933	46.72729180
	9	11	79.64624691	B	1.75	0.0838	45.39493342
	9	13	0.00000000	B	.	.	.
	10	1	0.00000000	B	.	.	.
	10	2	0.00000000	B	.	.	.
	10	3	0.00000000	B	.	.	.
	10	4	0.00000000	B	.	.	.
	10	5	0.00000000	B	.	.	.
	10	6	0.00000000	B	.	.	.
	10	7	0.00000000	B	.	.	.
	10	8	0.00000000	B	.	.	.
	10	9	0.00000000	B	.	.	.
	10	10	0.00000000	B	.	.	.
	10	11	0.00000000	B	.	.	.

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING TEMPERATURE EFFECTS

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: TWD

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
10 13	0.00000000 B	.	.	.

NOTE: THE X'X MATRIX HAS BEEN DEEMED SINGULAR AND A GENERALIZED INVERSE HAS BEEN EMPLOYED TO SOLVE THE NORMAL EQUATIONS. THE ABOVE ESTIMATES REPRESENT ONLY ONE OF MANY POSSIBLE SOLUTIONS TO THE NORMAL EQUATIONS. ESTIMATES FOLLOWED BY THE LETTER B ARE BIASED AND DO NOT ESTIMATE THE PARAMETER BUT ARE BLUE FOR SOME LINEAR COMBINATION OF PARAMETERS (OR ARE ZERO). THE EXPECTED VALUE OF THE BIASED ESTIMATORS MAY BE OBTAINED FROM THE GENERAL FORM OF ESTIMABLE FUNCTIONS. FOR THE BIASED ESTIMATORS, THE STD ERR IS THAT OF THE BIASED ESTIMATOR AND THE T VALUE TESTS H0: E(BIASED ESTIMATOR) = 0. ESTIMATES NOT FOLLOWED BY THE LETTER B ARE BLUE FOR THE PARAMETER.

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING FUEL SYSTEMS
HIGH TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
FUEL	10	1 2 3 4 5 6 7 8 9 10
SYSTEM	3	CARB PFI TBI
CAR	12	1 2 3 4 5 6 7 8 9 10 11 13

NUMBER OF OBSERVATIONS IN DATA SET = 178

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING FUEL SYSTEMS
HIGH TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	119	3882.38179553	32.62505711	8.18	27E-16	0.943768	28.3045
ERROR	58	231.32206173	3.98831141		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	177	4113.70385726			1.99707571		7.05567591

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
FUEL	9	484.20080286	13.49	24E-12	9	269.29441047	7.50	350E-9
SYSTEM	2	1696.70257081	212.71	20E-28	2	1650.79354373	206.95	40E-28
CAR(SYSTEM)	9	984.84178933	27.44	90E-19	9	950.92038294	26.49	20E-18
FUEL*SYSTEM	18	140.40134586	1.96	0.0282	18	123.66415876	1.72	0.0612
FUEL*CAR(SYSTEM)	81	576.13621667	1.78	0.0106	81	576.13621667	1.78	0.0106

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR(SYSTEM) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL	9	269.29441047	4.21	0.0002

TESTS OF HYPOTHESES USING THE TYPE III MS FOR CAR(SYSTEM) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
SYSTEM	2	1650.79354373	7.81	0.0108

TESTS OF HYPOTHESES USING THE TYPE III MS FOR CAR(SYSTEM) AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
PFI - CARB	1	1390.85801161	13.16	0.0055
TBI - CARB	1	702.55574043	6.65	0.0298
TBI - PFI	1	109.77470963	1.04	0.3347

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING FUEL SYSTEMS
HIGH TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

SYSTEM	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
CARB	9.87443111	0.21741407	50E-48
PFI	2.24488437	0.34508366	21E-9
TBI	4.72263583	0.32155974	34E-22

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING FUEL SYSTEMS
MEDIUM TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
FUEL	4	6 8 9 10
SYSTEM	3	CARB PFI TBI
CAR	12	1 2 3 4 5 6 7 8 9 10 11 13

NUMBER OF OBSERVATIONS IN DATA SET = 52

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING FUEL SYSTEMS
MEDIUM TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	47	753.91947130	16.04083981	4.20	0.0845	0.980147	37.7801
ERROR	4	15.27041281	3.81760320		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	51	769.18988411			1.95386878		5.17168719

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
FUEL	3	33.01988740	2.88	0.1664	3	24.23435523	2.12	0.2409
SYSTEM	2	283.99582985	37.20	0.0026	2	294.68186129	38.60	0.0024
CAR(SYSTEM)	9	312.50419771	9.10	0.0241	9	285.18997607	8.30	0.0284
FUEL*SYSTEM	6	2.20417833	0.10	0.9927	6	2.12730009	0.09	0.9934
FUEL*CAR(SYSTEM)	27	122.19537801	1.19	0.4901	27	122.19537801	1.19	0.4901

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR(SYSTEM) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL	3	24.23435523	1.78	0.1738

TESTS OF HYPOTHESES USING THE TYPE III MS FOR CAR(SYSTEM) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
SYSTEM	2	294.68186129	4.65	0.0410

TESTS OF HYPOTHESES USING THE TYPE III MS FOR CAR(SYSTEM) AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
PFI - CARB	1	262.53306369	8.28	0.0182
TBI - CARB	1	112.58589276	3.55	0.0921
TBI - PFI	1	21.55315496	0.68	0.4308

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING FUEL SYSTEMS
MEDIUM TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

SYSTEM	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
CARB	7.38036975	0.38616722	442E-7
PFI	1.79276025	0.55215762	0.0315
TBI	3.66822156	0.56403333	0.0029

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS
HIGH TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
FUEL	10	1 2 3 4 5 6 7 8 9 10
CAR	12	1 2 3 4 5 6 7 8 9 10 11 13

NUMBER OF OBSERVATIONS IN DATA SET = 178

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS
HIGH TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	119	3882.38179553	32.62505711	8.18	27E-16	0.943768	28.3045
ERROR	58	231.32206173	3.98831141		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	177	4113.70385726			1.99707571		7.05567591

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
FUEL	9	484.20080286	13.49	24E-12	9	369.10437150	10.28	28E-10
CAR	11	2681.54434014	61.12	95E-29	11	2606.48282273	59.41	20E-28
FUEL*CAR	99	716.62756253	1.81	0.0073	99	716.62756253	1.81	0.0073

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL	9	369.10437150	5.67	264E-8

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
MEOH MAT - LOW BASE	1	18.35485808	2.54	0.1145
MEOH SPL - LOW BASE	1	7.04088761	0.97	0.3264
ETOH MAT - LOW BASE	1	29.77046776	4.11	0.0452
ETOH SPL - LOW BASE	1	8.44038441	1.17	0.2826
MEOH MAT - MED BASE	1	5.02880940	0.69	0.4066
MEOH SPL - MED BASE	1	0.28311652	0.04	0.8436
ETOH MAT - MED BASE	1	9.99988438	1.38	0.2427
ETOH SPL - MED BASE	1	0.00410840	0.00	0.9810
ETOH SP - MEOH LOW	1	0.01500558	0.00	0.9638
ETOH MAT - MEOH LOW	1	1.30236255	0.18	0.6724
ETOH SP - MEOH MED	1	0.35725448	0.05	0.8246
ETOH MAT - MEOH MED	1	0.73481476	0.10	0.7507
MEOH SP - MAT LOW	1	2.44264507	0.34	0.5626
ETOH SP - MAT LOW	1	7.19023328	0.99	0.3214
MEOH SP - MAT MED	1	7.14063014	0.99	0.3230
ETOH SP - MAT MED	1	9.73000160	1.35	0.2489

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS
HIGH TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

FUEL	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
1	4.19658662	0.45576809	60E-14
2	5.71130025	0.53927208	35E-16
3	5.12160739	0.52627566	84E-15
4	6.15226506	0.55196257	48E-17
5	5.16551412	0.48520218	29E-16
6	7.72684357	0.44552480	13E-25
7	8.53424332	0.56436777	87E-23
8	7.55511324	0.46578617	32E-24
9	8.88053465	0.57650610	37E-23
10	7.74604786	0.44031381	63E-26

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS USING THE SQUARE ROOT OF TWD
HIGH TEMPERATURE DATA

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
FUEL	10	1 2 3 4 5 6 7 8 9 10
CAR	6	1 3 4 7 10 11

NUMBER OF OBSERVATIONS IN BY GROUP = 98

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS USING THE SQUARE ROOT OF TWD
HIGH TEMPERATURE DATA

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	59	1609.44785734	27.27877724	6.41	12E-9	0.908691	21.2368
ERROR	38	161.72436904	4.25590445		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	97	1771.17222638			2.06298435		9.71419526

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
FUEL	9	531.30299098	13.87	16E-10	9	416.97523631	10.89	39E-9
CAR	5	636.67211846	29.92	33E-13	5	605.11212678	28.44	70E-13
FUEL*CAR	45	441.47274790	2.31	0.0048	45	441.47274790	2.31	0.0048

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL	9	416.97523631	4.72	0.0002

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
MEOH MAT - LOW BASE	1	48.15640838	4.91	0.0318
MEOH SPL - LOW BASE	1	19.20843514	1.96	0.1686
ETOH MAT - LOW BASE	1	41.82221461	4.26	0.0447
ETOH SPL - LOW BASE	1	9.90408919	1.01	0.3204
MEOH MAT - MED BASE	1	0.12444346	0.01	0.9108
MEOH SPL - MED BASE	1	1.25600929	0.13	0.7222
ETOH MAT - MED BASE	1	2.72439715	0.28	0.6008
ETOH SPL - MED BASE	1	18.40555211	1.88	0.1776
ETOH SP - MEOH LOW	1	2.33117222	0.24	0.6283
ETOH MAT - MEOH LOW	1	0.06296411	0.01	0.9365
ETOH SP - MEOH MED	1	7.76790793	0.79	0.3783
ETOH MAT - MEOH MED	1	2.95428782	0.30	0.5859
MEOH SP - MAT LOW	1	4.93926425	0.50	0.4816
ETOH SP - MAT LOW	1	13.03993135	1.33	0.2550
MEOH SP - MAT MED	1	0.34625851	0.04	0.8518
ETOH SP - MAT MED	1	25.81603471	2.63	0.1118

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS USING THE SQUARE ROOT OF TWD
HIGH TEMPERATURE DATA

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

FUEL	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
1	5.9994324	0.6432484	23E-12
2	9.2707356	0.7293751	29E-16
3	8.1290627	0.7688289	71E-14
4	9.1418343	0.7688289	22E-15
5	7.3871626	0.6432484	64E-15
6	12.0613565	0.5787534	21E-23
7	11.8866146	0.8422098	11E-17
8	11.5790762	0.6731827	16E-20
9	12.8789666	0.8422098	80E-19
10	10.4100696	0.5436441	41E-22

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS USING THE SQUARE ROOT OF TWD
HIGH TEMPERATURE DATA

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
FUEL	10	1 2 3 4 5 6 7 8 9 10
CAR	3	5 6 13

NUMBER OF OBSERVATIONS IN BY GROUP = 36

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS USING THE SQUARE ROOT OF TWD
HIGH TEMPERATURE DATA

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	29	200.39575787	6.91019855	8.99	0.0056	0.977495	39.4372
ERROR	6	4.61379365	0.76896561		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	35	205.00955152			0.87690684		2.22355102

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
FUEL	9	34.44817345	4.98	0.0320	9	37.20220276	5.38	0.0267
CAR	2	87.35716854	56.80	0.0001	2	93.71451129	60.94	0.0001
FUEL*CAR	18	78.59041589	5.68	0.0201	18	78.59041589	5.68	0.0201

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL	9	37.20220276	0.95	0.5111

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
MEOH MAT - LOW BASE	1	0.20074831	0.05	0.8326
MEOH SPL - LOW BASE	1	0.95444723	0.22	0.6457
ETOH MAT - LOW BASE	1	0.42762483	0.10	0.7579
ETOH SPL - LOW BASE	1	0.54479344	0.12	0.7280
MEOH MAT - MED BASE	1	8.36462090	1.92	0.1832
MEOH SPL - MED BASE	1	3.41740337	0.78	0.3880
ETOH MAT - MED BASE	1	15.93852748	3.65	0.0721
ETOH SPL - MED BASE	1	13.00607897	2.98	0.1015
ETOH SP - MEOH LOW	1	2.45119060	0.56	0.4634
ETOH MAT - MEOH LOW	1	1.01198613	0.23	0.6360
ETOH SP - MEOH MED	1	3.81362792	0.87	0.3624
ETOH MAT - MEOH MED	1	1.10945528	0.25	0.6203
MEOH SP - MAT LOW	1	0.23312035	0.05	0.8199
ETOH SP - MAT LOW	1	0.00590396	0.00	0.9711
MEOH SP - MAT MED	1	1.63730415	0.38	0.5479
ETOH SP - MAT MED	1	0.30663531	0.07	0.7940

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS USING THE SQUARE ROOT OF TWD
HIGH TEMPERATURE DATA

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

FUEL	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
1	1.61000872	0.41337785	0.0080
2	1.27614237	0.50628240	0.0452
3	0.88191710	0.50628240	0.1322
4	2.09750958	0.50628240	0.0061
5	2.16024690	0.50628240	0.0053
6	1.00917350	0.46217049	0.0717
7	3.27008323	0.50628240	0.0007
8	2.31634667	0.41337785	0.0014
9	4.13010465	0.50628240	0.0002
10	3.69722102	0.46217049	0.0002

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS USING THE SQUARE ROOT OF TWD
HIGH TEMPERATURE DATA

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
FUEL	10	1 2 3 4 5 6 7 8 9 10
CAR	3	2 8 9

NUMBER OF OBSERVATIONS IN BY GROUP = 44

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS USING THE SQUARE ROOT OF TWD
HIGH TEMPERATURE DATA

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	29	368.96207426	12.72283015	2.74	0.0250	0.850249	42.3441
ERROR	14	64.98389904	4.64170707		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	43	433.94597330			2.15446213		5.08798502

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
FUEL	9	71.74871075	1.72	0.1757	9	74.99898411	1.80	0.1574
CAR	2	241.14031062	25.98	194E-7	2	252.09374486	27.16	152E-7
FUEL*CAR	18	56.07305289	0.67	0.7893	18	56.07305289	0.67	0.7893

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL	9	74.99898411	2.68	0.0361

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
MEOH MAT - LOW BASE	1	0.04038958	0.01	0.9106
MEOH SPL - LOW BASE	1	0.06426545	0.02	0.8874
ETOH MAT - LOW BASE	1	1.98638716	0.64	0.4350
ETOH SPL - LOW BASE	1	0.68087595	0.22	0.6457
MEOH MAT - MED BASE	1	3.60882088	1.16	0.2960
MEOH SPL - MED BASE	1	2.48855447	0.80	0.3832
ETOH MAT - MED BASE	1	0.03722332	0.01	0.9142
ETOH SPL - MED BASE	1	1.13387422	0.36	0.5538
ETOH SP - MEOH LOW	1	0.32677888	0.10	0.7498
ETOH MAT - MEOH LOW	1	2.16106038	0.69	0.4158
ETOH SP - MEOH MED	1	6.69109925	2.15	0.1600
ETOH MAT - MEOH MED	1	3.48597165	1.12	0.3041
MEOH SP - MAT LOW	1	0.18293973	0.06	0.8113
ETOH SP - MAT LOW	1	0.45071622	0.14	0.7081
MEOH SP - MAT MED	1	11.02345584	3.54	0.0762
ETOH SP - MAT MED	1	1.25900779	0.40	0.5330

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS USING THE SQUARE ROOT OF TWD
HIGH TEMPERATURE DATA

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

FUEL	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
1	3.17738289	1.01562319	0.0074
2	3.02758751	1.24387929	0.0289
3	3.34638711	1.01562319	0.0053
4	4.22788202	1.24387929	0.0043
5	3.72748428	1.01562319	0.0025
6	5.77548775	0.97238517	361E-7
7	7.09366089	1.13550124	214E-7
8	4.74505394	1.01562319	0.0004
9	5.63410068	1.24387929	0.0005
10	6.47043122	1.01562319	174E-7

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS USING THE SQUARE ROOT OF TWD
MEDIUM TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
FUEL	4	6 8 9 10
CAR	12	1 2 3 4 5 6 7 8 9 10 11 13

NUMBER OF OBSERVATIONS IN DATA SET = 52

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS USING THE SQUARE ROOT OF TWD
MEDIUM TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	47	753.91947130	16.04083981	4.20	0.0845	0.980147	37.7801
ERROR	4	15.27041281	3.81760320		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	51	769.18988411			1.95386878		5.17168719

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
FUEL	3	33.01988740	2.88	0.1664	3	28.04009558	2.45	0.2036
CAR	11	596.50002756	14.20	0.0103	11	576.52614518	13.73	0.0110
FUEL*CAR	33	124.39955635	0.99	0.5850	33	124.39955635	0.99	0.5850

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL	3	28.04009558	2.48	0.0783

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
MEOH SPL - MED BASE	1	20.86604337	5.54	0.0248
ETOH MAT - MED BASE	1	8.21969978	2.18	0.1493
ETOH SPL - MED BASE	1	19.90596559	5.28	0.0280
ETOH SPL - ETOH MAT	1	2.33087772	0.62	0.4373

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS USING THE SQUARE ROOT OF TWD
MEDIUM TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

FUEL	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
6	6.21792530	0.51488963	0.0003
8	4.43246521	0.56403333	0.0014
9	5.09730607	0.56403333	0.0008
10	4.47402473	0.56403333	0.0014

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS USING THE SQUAREROOT OF TWD
MEDIUM TEMPERATURE DATA

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
FUEL	4	6 8 9 10
CAR	6	1 3 4 7 10 11

NUMBER OF OBSERVATIONS IN BY GROUP = 27

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS USING THE SQUAREROOT OF TWD
MEDIUM TEMPERATURE DATA

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	23	323.96091160	14.08525703	3.34	0.1744	0.962434	27.8203
ERROR	3	12.64492067	4.21497356		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	26	336.60583227			2.05304008		7.37963707

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
FUEL	3	11.34889753	0.90	0.5344	3	17.51925892	1.39	0.3976
CAR	5	239.59460036	11.37	0.0364	5	213.38481394	10.13	0.0427
FUEL*CAR	15	73.01741371	1.15	0.5197	15	73.01741371	1.15	0.5197

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL	3	17.51925892	1.20	0.3437

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
MEOH SPL - MED BASE	1	13.73449090	2.82	0.1137
ETOH MAT - MED BASE	1	5.36887669	1.10	0.3103
ETOH SPL - MED BASE	1	11.10737120	2.28	0.1517
ETOH SPL - ETOH MAT	1	0.90267049	0.19	0.6729

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS USING THE SQUAREROOT OF TWD
MEDIUM TEMPERATURE DATA

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

FUEL	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
6	8.64355568	0.72585928	0.0013
8	6.64208292	0.83815010	0.0042
9	7.39218748	0.83815010	0.0031
10	6.84365292	0.83815010	0.0038

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS USING THE SQUAREROOT OF TWD
MEDIUM TEMPERATURE DATA

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
FUEL	4	6 8 9 10
CAR	3	5 6 13

NUMBER OF OBSERVATIONS IN BY GROUP = 13

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS USING THE SQUAREROOT OF TWD
MEDIUM TEMPERATURE DATA

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	11	42.73005953	3.88455087	1.48	0.5715	0.942113	82.0939
ERROR	1	2.62549213	2.62549213		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	12	45.35555166			1.62033704		1.97375956

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
FUEL	3	11.85423008	1.51	0.5253	3	8.53960224	1.08	0.5923
CAR	2	2.93662687	0.56	0.6870	2	2.49094741	0.47	0.7163
FUEL*CAR	6	27.93920170	1.77	0.5189	6	27.93920170	1.77	0.5189

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL	3	8.53960224	0.61	0.6320

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
MEOH SPL - MED BASE	1	6.48700884	1.39	0.2826
ETOH MAT - MED BASE	1	4.52323484	0.97	0.3624
ETOH SPL - MED BASE	1	5.05915063	1.09	0.3374
ETOH SPL - ETOH MAT	1	0.01374846	0.00	0.9584

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS USING THE SQUAREROOT OF TWD
MEDIUM TEMPERATURE DATA

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

FUEL	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
6	3.14575131	0.85309261	0.1688
8	1.15470054	0.93550203	0.4335
9	1.48316325	0.93550203	0.3582
10	1.38742589	0.93550203	0.3777

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS USING THE SQUAREROOT OF TWO
MEDIUM TEMPERATURE DATA

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
FUEL	4	6 8 9 10
CAR	3	2 8 9

NUMBER OF OBSERVATIONS IN BY GROUP = 12

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS USING THE SQUAREROOT OF TWD
MEDIUM TEMPERATURE DATA

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	11	95.52980682	8.68452789	.	.	1.000000	0.0000
ERROR	0	0.00000000	0.00000000		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	11	95.52980682			0.00000000		3.66822156

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
FUEL	3	4.97682950	.	.	3	4.97682950	.	.
CAR	2	69.31421471	.	.	2	69.31421471	.	.
FUEL*CAR	6	21.23876261	.	.	6	21.23876261	.	.

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL	3	4.97682950	0.47	0.7150

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
MEOH SPL - MED BASE	1	1.97631907	0.56	0.4832
ETOH MAT - MED BASE	1	0.15087854	0.04	0.8433
ETOH SPL - MED BASE	1	3.92432026	1.11	0.3329
ETOH SPL - ETOH MAT	1	2.53824369	0.72	0.4298

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
FUEL COMPARISONS USING THE SQUAREROOT OF TWD
MEDIUM TEMPERATURE DATA

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

FUEL	SRTWD LSMEAN
6	4.43883854
8	3.29009445
9	4.12168606
10	2.82138721

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING VOLATILITY LEVEL
HIGH TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
VOL	2	LOW MEDIUM
FUEL	10	1 2 3 4 5 6 7 8 9 10
CAR	12	1 2 3 4 5 6 7 8 9 10 11 13

NUMBER OF OBSERVATIONS IN DATA SET = 178

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING VOLATILITY LEVEL
HIGH TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	119	3882.38179553	32.62505711	8.18	27E-16	0.943768	28.3045
ERROR	58	231.32206173	3.98831141		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	177	4113.70385726			1.99707571		7.05567591

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
VOL	1	397.01208430	99.54	34E-15	1	307.67806805	77.14	30E-13
FUEL(VOL)	8	87.19780856	2.73	0.0125	8	54.16877677	1.70	0.1184
CAR	11	2681.54434014	61.12	95E-29	11	2606.48282273	59.41	20E-28
VOL*CAR	11	272.37084879	6.21	124E-8	11	238.46651920	5.44	716E-8
FUEL*CAR(VOL)	88	444.25671374	1.27	0.1694	88	444.25671374	1.27	0.1694

TESTS OF HYPOTHESES USING THE TYPE III MS FOR VOL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
VOL	1	307.67806805	14.19	0.0031

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR(VOL) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL(VOL)	8	54.16877677	1.34	0.2340

TESTS OF HYPOTHESES USING THE TYPE III MS FOR VOL*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
MEDIUM - LOW	1	307.67806805	14.19	0.0031

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING VOLATILITY LEVEL
HIGH TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

VOL	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
LOW	5.26945469	0.22939824	83E-32
MEDIUM	8.08873653	0.22451687	21E-42

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING VOLATILITY LEVEL
HIGH TEMPERATURE DATA

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
VOL	2	LOW MEDIUM
FUEL	10	1 2 3 4 5 6 7 8 9 10
CAR	6	1 3 4 7 10 11

NUMBER OF OBSERVATIONS IN BY GROUP = 98

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING VOLATILITY LEVEL
HIGH TEMPERATURE DATA

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	59	1609.44785734	27.27877724	6.41	12E-9	0.908691	21.2368
ERROR	38	161.72436904	4.25590445		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	97	1771.17222638			2.06298435		9.71419526

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
VOL	1	386.22300008	90.75	13E-12	1	301.00873986	70.73	33E-11
FUEL(VOL)	8	145.07908290	4.26	0.0010	8	99.43952900	2.92	0.0121
CAR	5	636.67211846	29.92	33E-13	5	605.11212678	28.44	70E-13
VOL*CAR	5	203.15616618	9.55	583E-8	5	188.41674147	8.85	122E-7
FUEL*CAR(VOL)	40	238.31658171	1.40	0.1499	40	238.31658171	1.40	0.1499

TESTS OF HYPOTHESES USING THE TYPE III MS FOR VOL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
VOL	1	301.00873986	7.99	0.0368

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR(VOL) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL(VOL)	8	99.43952900	2.09	0.0602

TESTS OF HYPOTHESES USING THE TYPE III MS FOR VOL*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
MEDIUM - LOW	1	301.00873986	7.99	0.0368

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING VOLATILITY LEVEL
HIGH TEMPERATURE DATA

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

VOL	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
LOW	7.9856455	0.3188555	32E-26
MEDIUM	11.7632167	0.3163741	17E-32

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING VOLATILITY LEVEL
HIGH TEMPERATURE DATA

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
VOL	2	LOW MEDIUM
FUEL	10	1 2 3 4 5 6 7 8 9 10
CAR	3	5 6 13

NUMBER OF OBSERVATIONS IN BY GROUP = 36

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING VOLATILITY LEVEL
HIGH TEMPERATURE DATA

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	29	200.39575787	6.91019855	8.99	0.0056	0.977495	39.4372
ERROR	6	4.61379365	0.76896561		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	35	205.00955152			0.87690684		2.22355102

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
VOL	1	17.40894959	22.64	0.0031	1	13.64059771	17.74	0.0056
FUEL(VOL)	8	17.03922386	2.77	0.1156	8	25.01223727	4.07	0.0522
CAR	2	87.35716854	56.80	0.0001	2	93.71451129	60.94	0.0001
VOL•CAR	2	1.55424911	1.01	0.4185	2	0.96041016	0.62	0.5671
FUEL•CAR(VOL)	16	77.03616678	6.26	0.0160	16	77.03616678	6.26	0.0160

TESTS OF HYPOTHESES USING THE TYPE III MS FOR VOL•CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
VOL	1	13.64059771	28.41	0.0334

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL•CAR(VOL) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL(VOL)	8	25.01223727	0.65	0.7267

TESTS OF HYPOTHESES USING THE TYPE III MS FOR VOL•CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
MEDIUM - LOW	1	13.64059771	28.41	0.0334

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING VOLATILITY LEVEL
HIGH TEMPERATURE DATA

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

VOL	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
LOW	1.00518293	0.21873900	0.0003
MEDIUM	2.88458581	0.21078217	946E-8

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING VOLATILITY LEVEL
HIGH TEMPERATURE DATA

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
VOL	2	LOW MEDIUM
FUEL	10	1 2 3 4 5 6 7 8 9 10
CAR	3	2 8 9

NUMBER OF OBSERVATIONS IN BY GROUP = 44

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING VOLATILITY LEVEL
HIGH TEMPERATURE DATA

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	29	368.96207426	12.72283015	2.74	0.0250	0.850249	42.3441
ERROR	14	64.98389904	4.64170707		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	43	433.94597330			2.15446213		5.08798502

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
VOL	1	55.01086246	11.85	0.0040	1	57.53128647	12.39	0.0034
FUEL(VOL)	8	16.73784829	0.45	0.8705	8	15.93170057	0.43	0.8845
CAR	2	241.14031062	25.98	194E-7	2	252.09374486	27.16	152E-7
VOL*CAR	2	1.80456670	0.19	0.8255	2	1.92194702	0.21	0.8154
FUEL*CAR(VOL)	16	54.26848619	0.73	0.7286	16	54.26848619	0.73	0.7286

TESTS OF HYPOTHESES USING THE TYPE III MS FOR VOL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
VOL	1	57.53128647	59.87	0.0163

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR(VOL) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL(VOL)	8	15.93170057	0.50	0.7745

TESTS OF HYPOTHESES USING THE TYPE III MS FOR VOL*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
MEDIUM - LOW	1	57.53128647	59.87	0.0163

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
EVALUATING VOLATILITY LEVEL
HIGH TEMPERATURE DATA

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

VOL	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
LOW	3.50134476	0.49755172	589E-8
MEDIUM	5.94392690	0.48353335	69E-10

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

HIGH TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
ADJUST	3	BASE MATCH SPLASH
FUEL	10	1 2 3 4 5 6 7 8 9 10
CAR	12	1 2 3 4 5 6 7 8 9 10 11 13

NUMBER OF OBSERVATIONS IN DATA SET = 178

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

HIGH TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	119	3882.38179553	32.62505711	8.18	27E-16	0.943768	28.3045
ERROR	58	231.32206173	3.98831141		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	177	4113.70385726			1.99707571		7.05567591

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
ADJUST	2	24.35201885	3.05	0.0549	2	45.32032717	5.68	0.0056
FUEL(ADJUST)	7	459.85787401	16.47	97E-13	7	333.04585385	11.93	26E-10
CAR	11	2681.54434014	61.12	95E-29	11	2607.21961434	59.43	20E-28
ADJUST*CAR	22	175.73631073	2.00	0.0183	22	169.72546129	1.93	0.0236
FUEL*CAR(ADJUST)	77	540.89125180	1.76	0.0126	77	540.89125180	1.76	0.0126

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ADJUST*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
ADJUST	2	45.32032717	2.94	0.0740

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR(ADJUST) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL(ADJUST)	7	333.04585385	6.77	292E-8

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ADJUST*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
MATCH - MED BASE	1	40.97889019	5.31	0.0310
SPLASH - MED BASE	1	4.75150971	0.62	0.4409
SPLASH - MATCH	1	25.01906218	3.24	0.0855

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

HIGH TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

ADJUST	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
BASE	5.96171509	0.31867574	30E-27
MATCH	7.31958582	0.27909982	74E-35
SPLASH	6.30729565	0.24021088	32E-35

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

HIGH TEMPERATURE DATA

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
ADJUST	3	BASE MATCH SPLASH
FUEL	10	1 2 3 4 5 6 7 8 9 10
CAR	6	1 3 4 7 10 11

NUMBER OF OBSERVATIONS IN BY GROUP = 98

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

HIGH TEMPERATURE DATA

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	59	1609.44785734	27.27877724	6.41	12E-9	0.908691	21.2368
ERROR	38	161.72436904	4.25590445		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	97	1771.17222638			2.06298435		9.71419526

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
ADJUST	2	38.10548714	4.48	0.0180	2	46.33139183	5.44	0.0083
FUEL(ADJUST)	7	493.19750384	16.56	87E-11	7	391.35747083	13.14	19E-9
CAR	5	636.67211846	29.92	33E-13	5	637.94081724	29.98	32E-13
ADJUST*CAR	10	119.74422774	2.81	0.0103	10	119.68265552	2.81	0.0103
FUEL*CAR(ADJUST)	35	321.72852016	2.16	0.0108	35	321.72852016	2.16	0.0108

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ADJUST*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
ADJUST	2	46.33139183	1.94	0.1947

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR(ADJUST) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL(ADJUST)	7	391.35747083	6.08	0.0001

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ADJUST*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
MATCH - MED BASE	1	38.27675699	3.20	0.1040
SPLASH - MED BASE	1	1.71624426	0.14	0.7128
SPLASH - MATCH	1	31.88519966	2.66	0.1337

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

HIGH TEMPERATURE DATA

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

ADJUST	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
BASE	9.0303945	0.4326442	20E-23
MATCH	10.7945378	0.3985694	19E-27
SPLASH	9.3763428	0.3310580	37E-28

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

HIGH TEMPERATURE DATA

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
ADJUST	3	BASE MATCH SPLASH
FUEL	10	1 2 3 4 5 6 7 8 9 10
CAR	3	5 6 13

NUMBER OF OBSERVATIONS IN BY GROUP = 36

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

HIGH TEMPERATURE DATA

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	29	200.39575787	6.91019855	8.99	0.0056	0.977495	39.4372
ERROR	6	4.61379365	0.76896561		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	35	205.00955152			0.87690684		2.22355102

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
ADJUST	2	9.92891533	6.46	0.0319	2	9.31694647	6.06	0.0363
FUEL(ADJUST)	7	24.51925811	4.56	0.0419	7	28.11005909	5.22	0.0307
CAR	2	87.35716654	56.80	0.0001	2	77.19957492	50.20	0.0002
ADJUST*CAR	4	14.29982830	4.65	0.0474	4	18.79314412	6.11	0.0261
FUEL*CAR(ADJUST)	14	64.29058759	5.97	0.0186	14	64.29058759	5.97	0.0186

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ADJUST*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
ADJUST	2	9.31694647	0.99	0.4470

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR(ADJUST) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL(ADJUST)	7	28.11005909	0.87	0.5496

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ADJUST*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
MATCH - MED BASE	1	9.19184853	1.96	0.2345
SPLASH - MED BASE	1	4.60134269	0.98	0.3784
SPLASH - MATCH	1	1.18075824	0.25	0.6425

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

HIGH TEMPERATURE DATA

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

ADJUST	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
BASE	1.30963611	0.31003339	0.0055
MATCH	2.69345996	0.25314120	406E-7
SPLASH	2.26393292	0.23679191	748E-7

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

HIGH TEMPERATURE DATA

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
ADJUST	3	BASE MATCH SPLASH
FUEL	10	1 2 3 4 5 6 7 8 9 10
CAR	3	2 8 9

NUMBER OF OBSERVATIONS IN BY GROUP = 44

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

HIGH TEMPERATURE DATA

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	29	368.96207426	12.72283015	2.74	0.0250	0.850249	42.3441
ERROR	14	64.98389904	4.64170707		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	43	433.94597330			2.15446213		5.08798502

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
ADJUST	2	0.25331703	0.03	0.9731	2	1.84547969	0.20	0.8220
FUEL(ADJUST)	7	71.49530372	2.20	0.0991	7	72.50239627	2.23	0.0953
CAR	2	241.14031062	25.98	194E-7	2	242.26536424	26.10	189E-7
ADJUST*CAR	4	24.43860403	1.32	0.3118	4	20.90454406	1.13	0.3838
FUEL*CAR(ADJUST)	14	31.63444886	0.49	0.9048	14	31.63444886	0.49	0.9048

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ADJUST*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
ADJUST	2	1.84547969	0.18	0.8443

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR(ADJUST) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL(ADJUST)	7	72.50239627	4.58	0.0075

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ADJUST*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
MATCH - MED BASE	1	1.44759039	0.28	0.6265
SPLASH - MED BASE	1	0.05702862	0.01	0.9218
SPLASH - MATCH	1	1.32284439	0.25	0.6413

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

HIGH TEMPERATURE DATA

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

ADJUST	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
BASE	4.47643532	0.70303332	175E-7
MATCH	4.99580778	0.60884471	102E-8
SPLASH	4.57256414	0.50781159	337E-9

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

MEDIUM TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
ADJUST	3	BASE MATCH SPLASH
FUEL	4	6 8 9 10
CAR	12	1 2 3 4 5 6 7 8 9 10 11 13

NUMBER OF OBSERVATIONS IN DATA SET = 52

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

MEDIUM TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	47	753.91947130	16.04083981	4.20	0.0845	0.980147	37.7801
ERROR	4	15.27041281	3.81760320		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	51	769.18988411			1.95386878		5.17168719

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
ADJUST	2	33.00052423	4.32	0.1000	2	28.02973241	3.67	0.1244
FUEL(ADJUST)	1	0.01036316	0.00	0.9609	1	0.01036316	0.00	0.9609
CAR	11	596.50002756	14.20	0.0103	11	576.19559248	13.72	0.0110
ADJUST*CAR	22	83.94890088	1.00	0.5716	22	83.94890088	1.00	0.5716
FUEL*CAR(ADJUST)	11	40.45065547	0.96	0.5693	11	40.45065547	0.96	0.5693

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ADJUST*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
ADJUST	2	28.02973241	3.67	0.0420

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR(ADJUST) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL(ADJUST)	1	0.01036316	0.00	0.9586

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ADJUST*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
MATCH - MED BASE	1	8.21969978	2.15	0.1563
SPLASH - MED BASE	1	28.02686098	7.34	0.0128
SPLASH - MATCH	1	3.31851756	0.87	0.3612

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

MEDIUM TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

ADJUST	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
BASE	6.21792530	0.51488963	0.0003
MATCH	5.09730607	0.56403333	0.0008
SPLASH	4.45324497	0.39883179	0.0004

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

MEDIUM TEMPERATURE DATA

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
ADJUST	3	BASE MATCH SPLASH
FUEL	4	6 8 9 10
CAR	6	1 3 4 7 10 11

NUMBER OF OBSERVATIONS IN BY GROUP = 27

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

MEDIUM TEMPERATURE DATA

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	23	323.96091160	14.08525703	3.34	0.1744	0.962434	27.8203
ERROR	3	12.64492067	4.21497356		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	26	336.60583227			2.05304008		7.37963707

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
ADJUST	2	11.22700614	1.33	0.3855	2	17.39736753	2.06	0.2731
FUEL(ADJUST)	1	0.12189139	0.03	0.8758	1	0.12189139	0.03	0.8758
CAR	5	239.59460036	11.37	0.0364	5	214.19901738	10.16	0.0425
ADJUST*CAR	10	41.29777698	0.98	0.5759	10	41.29777698	0.98	0.5759
FUEL*CAR(ADJUST)	5	31.71963672	1.51	0.3911	5	31.71963672	1.51	0.3911

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ADJUST*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
ADJUST	2	17.39736753	2.11	0.1724

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR(ADJUST) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL(ADJUST)	1	0.12189139	0.02	0.8952

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ADJUST*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
MATCH - MED BASE	1	5.36887669	1.30	0.2808
SPLASH - MED BASE	1	17.34054692	4.20	0.0676
SPLASH - MATCH	1	1.68646355	0.41	0.5372

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

MEDIUM TEMPERATURE DATA

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

ADJUST	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
BASE	8.64355568	0.72585928	0.0013
MATCH	7.39218748	0.83815010	0.0031
SPLASH	6.74286792	0.59266162	0.0015

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

MEDIUM TEMPERATURE DATA

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
ADJUST	3	BASE MATCH SPLASH
FUEL	4	6 8 9 10
CAR	3	5 6 13

NUMBER OF OBSERVATIONS IN BY GROUP = 13

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

MEDIUM TEMPERATURE DATA

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	11	42.73005953	3.88455087	1.48	0.5715	0.942113	82.0939
ERROR	1	2.62549213	2.62549213		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	12	45.35555166			1.62033704		1.97375956

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
ADJUST	2	11.77298933	2.24	0.4270	2	8.45836061	1.61	0.4867
FUEL(ADJUST)	1	0.08124163	0.03	0.8891	1	0.08124163	0.03	0.8891
CAR	2	2.93662687	0.56	0.6870	2	2.41813620	0.46	0.7215
ADJUST*CAR	4	19.98454494	1.90	0.4914	4	19.98454494	1.90	0.4914
FUEL*CAR(ADJUST)	2	7.95465675	1.51	0.4981	2	7.95465675	1.51	0.4981

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ADJUST*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
ADJUST	2	8.45836061	0.85	0.4937

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR(ADJUST) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL(ADJUST)	1	0.08124163	0.02	0.8995

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ADJUST*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
MATCH - MED BASE	1	4.52323484	0.91	0.3952
SPLASH - MED BASE	1	7.90752480	1.58	0.2768
SPLASH - MATCH	1	0.08997285	0.02	0.8997

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

MEDIUM TEMPERATURE DATA

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

ADJUST	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
BASE	3.14575131	0.85399261	0.1688
MATCH	1.48316325	0.93550203	0.3582
SPLASH	1.27106321	0.66149983	0.3055

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

MEDIUM TEMPERATURE DATA

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
ADJUST	3	BASE MATCH SPLASH
FUEL	4	6 8 9 10
CAR	3	2 8 9

NUMBER OF OBSERVATIONS IN BY GROUP = 12

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

MEDIUM TEMPERATURE DATA

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	11	95.52980682	8.68452789	.	.	1.000000	0.0000
ERROR	0	0.00000000	0.00000000		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	11	95.52980682			0.00000000		3.66822156

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
ADJUST	2	4.64600488	.	.	2	4.64600488	.	.
FUEL(ADJUST)	1	0.33082462	.	.	1	0.33082462	.	.
CAR	2	69.31421471	.	.	2	74.06290375	.	.
ADJUST*CAR	4	20.98599510	.	.	4	20.98599510	.	.
FUEL*CAR(ADJUST)	2	0.25276751	.	.	2	0.25276751	.	.

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ADJUST*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
ADJUST	2	4.64600488	0.44	0.6703

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR(ADJUST) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL(ADJUST)	1	0.33082462	2.62	0.2471

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ADJUST*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
MATCH - MED BASE	1	0.15087854	0.03	0.8736
SPLASH - MED BASE	1	3.82348468	0.73	0.4414
SPLASH - MATCH	1	2.27060281	0.43	0.5466

EVALUATING TYPE OF VOLATILITY ADJUSTMENT

MEDIUM TEMPERATURE DATA

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

ADJUST	SRTWD LSMEAN
BASE	4.43883854
MATCH	4.12168606
SPLASH	3.05618083

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
HIGH TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
ALCOHOL	3	BASE ETOH OXY
FUEL	10	1 2 3 4 5 6 7 8 9 10
CAR	12	1 2 3 4 5 6 7 8 9 10 11 13

NUMBER OF OBSERVATIONS IN DATA SET = 178

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
HIGH TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	119	3882.38179553	32.62505711	8.18	27E-16	0.943768	28.3045
ERROR	58	231.32206173	3.98831141		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	177	4113.70385726			1.99707571		7.05567591

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
ALCOHOL	2	19.00686568	2.38	0.1013	2	25.71711476	3.22	0.0470
FUEL(ALCOHOL)	7	465.20302718	16.66	78E-13	7	347.16284526	12.44	13E-10
CAR	11	2681.54434014	61.12	95E-29	11	2607.21961434	59.43	20E-28
ALCOHOL*CAR	22	91.47903576	1.04	0.4323	22	88.63893116	1.01	0.4674
FUEL*CAR(ALCOHOL)	77	625.14852677	2.04	0.0026	77	625.14852677	2.04	0.0026

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ALCOHOL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
ALCOHOL	2	25.71711476	3.19	0.0607

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR(ALCOHOL) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL(ALCOHOL)	7	347.16284526	6.11	109E-7

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ALCOHOL*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
ETHANOL - BASE	1	24.89282301	6.18	0.0210
OXINOL - BASE	1	13.82708279	3.43	0.0774
OXINOL - ETHANOL	1	1.92382256	0.48	0.4968

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
HIGH TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

ALCOHOL	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
BASE	5.96171509	0.31867574	30E-27
ETOH	6.98631542	0.25815685	14E-35
OXY	6.73056605	0.26258905	25E-34

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
HIGH TEMPERATURE DATA

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
ALCOHOL	3	BASE ETOH OXY
FUEL	10	1 2 3 4 5 6 7 8 9 10
CAR	6	1 3 4 7 10 11

NUMBER OF OBSERVATIONS IN BY GROUP = 98

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
HIGH TEMPERATURE DATA

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	59	1609.44785734	27.27877724	6.41	12E-9	0.908691	21.2368
ERROR	38	161.72436904	4.25590445		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	97	1771.17222638			2.06298435		9.71419526

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
ALCOHOL	2	25.61481652	3.01	0.0612	2	19.44060630	2.28	0.1157
FUEL(ALCOHOL)	7	505.68817446	16.97	62E-11	7	406.67681022	13.65	11E-9
CAR	5	636.67211846	29.92	33E-13	5	637.94081724	29.98	32E-13
ALCOHOL*CAR	10	47.92794119	1.13	0.3690	10	51.89382494	1.22	0.3101
FUEL*CAR(ALCOHOL)	35	393.54480671	2.64	0.0020	35	393.54480671	2.64	0.0020

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ALCOHOL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
ALCOHOL	2	19.44060630	1.87	0.2037

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR(ALCOHOL) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL(ALCOHOL)	7	406.67681022	5.17	0.0004

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ALCOHOL*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
ETHANOL - BASE	1	11.61959402	2.24	0.1654
OXINOL - BASE	1	18.13811050	3.50	0.0911
OXINOL - ETHANOL	1	1.08709794	0.21	0.6570

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
HIGH TEMPERATURE DATA

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

ALCOHOL	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
BASE	9.0303945	0.4326442	20E-23
ETOH	9.9545083	0.3544126	50E-28
OXY	10.2163722	0.3779532	20E-27

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
HIGH TEMPERATURE DATA

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
ALCOHOL	3	BASE ETOH OXY
FUEL	10	1 2 3 4 5 6 7 8 9 10
CAR	3	5 6 13

NUMBER OF OBSERVATIONS IN BY GROUP = 36

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
HIGH TEMPERATURE DATA

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	29	200.39575787	6.91019855	8.99	0.0056	0.977495	39.4372
ERROR	6	4.61379365	0.76896561		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	35	205.00955152			0.87690684		2.22355102

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
ALCOHOL	2	13.02538542	8.47	0.0179	2	15.69668624	10.21	0.0117
FUEL(ALCOHOL)	7	21.42278803	3.98	0.0564	7	21.43226155	3.98	0.0564
CAR	2	87.35716854	56.80	0.0001	2	77.19957492	50.20	0.0002
ALCOHOL*CAR	4	22.81314541	7.42	0.0166	4	20.11481597	6.54	0.0223
FUEL*CAR(ALCOHOL)	14	55.77727047	5.18	0.0264	14	55.77727047	5.18	0.0264

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ALCOHOL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
ALCOHOL	2	15.69668624	1.56	0.3155

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR(ALCOHOL) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL(ALCOHOL)	7	21.43226155	0.77	0.6227

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ALCOHOL*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
ETHANOL - BASE	1	14.30087144	2.84	0.1670
OXINOL - BASE	1	1.94889104	0.39	0.5673
OXINOL - ETHANOL	1	7.53629825	1.50	0.2880

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
HIGH TEMPERATURE DATA

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

ALCOHOL	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
BASE	1.30063611	0.31003339	0.0055
ETOH	3.02127054	0.24781131	185E-7
OXY	1.93612234	0.24236425	0.0002

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
HIGH TEMPERATURE DATA

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
ALCOHOL	3	BASE ETOH OXY
FUEL	10	1 2 3 4 5 6 7 8 9 10
CAR	3	2 8 9

NUMBER OF OBSERVATIONS IN BY GROUP = 44

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
HIGH TEMPERATURE DATA

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	29	368.96207426	12.72283015	2.74	0.0250	0.850249	42.3441
ERROR	14	64.98389904	4.64170707		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	43	433.94597330			2.15446213		5.08798502

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
ALCOHOL	2	4.15856416	0.45	0.6478	2	2.22260150	0.24	0.7902
FUEL(ALCOHOL)	7	67.59014659	2.08	0.1153	7	72.78202251	2.24	0.0943
CAR	2	241.14031062	25.98	194E-7	2	242.26536424	26.10	189E-7
ALCOHOL*CAR	4	0.94534765	0.05	0.9946	4	3.15430287	0.17	0.9502
FUEL*CAR(ALCOHOL)	14	55.12770524	0.85	0.6187	14	55.12770524	0.85	0.6187

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ALCOHOL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
ALCOHOL	2	2.22260150	1.41	0.3441

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR(ALCOHOL) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL(ALCOHOL)	7	72.78202251	2.64	0.0579

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ALCOHOL*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
ETHANOL - BASE	1	1.64856032	2.09	0.2217
OXINOL - BASE	1	0.03434635	0.04	0.8449
OXINOL - ETHANOL	1	1.57331817	2.00	0.2307

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
HIGH TEMPERATURE DATA

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

ALCOHOL	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
BASE	4.47643532	0.70303332	175E-7
ETOH	5.01497455	0.56775062	424E-9
OXY	4.55339736	0.55337486	985E-9

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
MEDIUM TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
ALCOHOL	3	BASE ETOH OXY
FUEL	4	6 8 9 10
CAR	12	1 2 3 4 5 6 7 8 9 10 11 13

NUMBER OF OBSERVATIONS IN DATA SET = 52

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
MEDIUM TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	47	753.91947130	16.04083981	4.20	0.0845	0.980147	37.7801
ERROR	4	15.27041281	3.81760320		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	51	769.18988411			1.95386878		5.17168719

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
ALCOHOL	2	30.68000067	4.02	0.1104	2	25.70021785	3.37	0.1389
FUEL(ALCOHOL)	1	2.33087772	0.61	0.4782	1	2.33087772	0.61	0.4782
CAR	11	596.50002756	14.20	0.0103	11	567.92850106	13.52	0.0113
ALCOHOL*CAR	22	82.65918137	0.98	0.5793	22	82.65918137	0.98	0.5793
FUEL*CAR(ALCOHOL)	11	41.74037497	0.99	0.5548	11	41.74037497	0.99	0.5548

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ALCOHOL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
ALCOHOL	2	25.70021785	3.42	0.0508

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR(ALCOHOL) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL(ALCOHOL)	1	2.33087772	0.61	0.4497

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ALCOHOL*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
ETHANOL - BASE	1	18.46231580	4.91	0.0373
OXINOL - BASE	1	20.86604337	5.55	0.0278
OXINOL - ETHANOL	1	0.99800300	0.27	0.6114

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
MEDIUM TEMPERATURE DATA

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

ALCOHOL	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
BASE	6.21792530	0.51488963	0.0003
ETOH	4.78566540	0.39883179	0.0003
OXY	4.43246521	0.56403333	0.0014

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
MEDIUM TEMPERATURE DATA

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
ALCOHOL	3	BASE ETOH OXY
FUEL	4	6 8 9 10
CAR	6	1 3 4 7 10 11

NUMBER OF OBSERVATIONS IN BY GROUP = 27

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
MEDIUM TEMPERATURE DATA

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	23	323.96001160	14.08525703	3.34	0.1744	0.962434	27.8203
ERROR	3	12.64492067	4.21497356		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	26	336.60583227			2.05304008		7.37963707

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
ALCOHOL	2	10.44622705	1.24	0.4052	2	16.61658844	1.97	0.2841
FUEL(ALCOHOL)	1	0.90267049	0.21	0.6750	1	0.90267049	0.21	0.6750
CAR	5	239.59400036	11.37	0.0364	5	207.94359907	9.87	0.0442
ALCOHOL*CAR	10	36.26388617	0.86	0.6282	10	36.26388617	0.86	0.6282
FUEL*CAR(ALCOHOL)	5	36.75352754	1.74	0.3432	5	36.75352754	1.74	0.3432

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ALCOHOL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
ALCOHOL	2	16.61658844	2.29	0.1517

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR(ALCOHOL) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL(ALCOHOL)	1	0.90267049	0.12	0.7403

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ALCOHOL*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
ETHANOL - BASE	1	11.17230533	3.08	0.1097
OXINOL - BASE	1	13.73449000	3.79	0.0803
OXINOL - ETHANOL	1	0.90568445	0.25	0.6281

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
MEDIUM TEMPERATURE DATA

SYSTEM=CARB

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

ALCOHOL	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
BASE	8.64355568	0.72585928	0.0013
ETOH	7.11792020	0.50266162	0.0012
OXY	6.64208292	0.83815010	0.0042

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
MEDIUM TEMPERATURE DATA

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
ALCOHOL	3	BASE ETOH OXY
FUEL	4	6 8 9 10
CAR	3	5 6 13

NUMBER OF OBSERVATIONS IN BY GROUP = 13

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
MEDIUM TEMPERATURE DATA

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	11	42.73005953	3.88455087	1.48	0.5715	0.942113	82.0939
ERROR	1	2.62549213	2.62549213		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	12	45.35555166			1.62033704		1.97375956

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
ALCOHOL	2	11.84048249	2.25	0.4260	2	8.52585378	1.62	0.4852
FUEL(ALCOHOL)	1	0.01374846	0.01	0.9540	1	0.01374846	0.01	0.9540
CAR	2	2.93662687	0.56	0.6870	2	5.22203231	0.99	0.5784
ALCOHOL*CAR	4	27.19891685	2.59	0.4320	4	27.19891685	2.59	0.4320
FUEL*CAR(ALCOHOL)	2	0.74028484	0.14	0.8832	2	0.74028484	0.14	0.8832

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ALCOHOL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
ALCOHOL	2	8.52585378	0.63	0.5796

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR(ALCOHOL) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL(ALCOHOL)	1	0.01374846	0.04	0.8650

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ALCOHOL*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
ETHANOL - BASE	1	6.58274011	0.97	0.3809
OXINOL - BASE	1	6.48700884	0.95	0.3840
OXINOL - ETHANOL	1	0.15746602	0.02	0.8864

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
MEDIUM TEMPERATURE DATA

SYSTEM=PFI

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

ALCOHOL	SRTWD LSMEAN	STD ERR LSMEAN	PROB > |T| H0:LSMEAN=0
BASE	3.14575131	0.85309261	0.1688
ETOH	1.43529457	0.86149983	0.2749
OXY	1.15470054	0.93550203	0.4335

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
MEDIUM TEMPERATURE DATA

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
ALCOHOL	3	BASE ETOH OXY
FUEL	4	6 8 9 10
CAR	3	2 8 9

NUMBER OF OBSERVATIONS IN BY GROUP = 12

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
MEDIUM TEMPERATURE DATA

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: SRTWD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	11	95.52980682	8.68452789	.	.	1.000000	0.0000
ERROR	0	0.00000000	0.00000000		ROOT MSE		SRTWD MEAN
CORRECTED TOTAL	11	95.52980682			0.00000000		3.66822156

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
ALCOHOL	2	2.44058582	.	.	2	2.44058582	.	.
FUEL(ALCOHOL)	1	2.53624369	.	.	1	2.53624369	.	.
CAR	2	69.31421471	.	.	2	73.19375654	.	.
ALCOHOL*CAR	4	18.11398493	.	.	4	18.11398493	.	.
FUEL*CAR(ALCOHOL)	2	3.12477768	.	.	2	3.12477768	.	.

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ALCOHOL*CAR AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
ALCOHOL	2	2.44058582	0.27	0.7766

TESTS OF HYPOTHESES USING THE TYPE III MS FOR FUEL*CAR(ALCOHOL) AS AN ERROR TERM

SOURCE	DF	TYPE III SS	F VALUE	PR > F
FUEL(ALCOHOL)	1	2.53624369	1.62	0.3307

TESTS OF HYPOTHESES USING THE TYPE III MS FOR ALCOHOL*CAR AS AN ERROR TERM

CONTRAST	DF	SS	F VALUE	PR > F
ETHANOL - BASE	1	1.87138463	0.41	0.5553
OXINOL - BASE	1	1.97631907	0.44	0.5450
OXINOL - ETHANOL	1	0.06518374	0.01	0.9103

EVALUATING TYPE OF VOLATILITY ADJUSTMENT
EVALUATING TYPE OF ALCOHOL
MEDIUM TEMPERATURE DATA

SYSTEM=TBI

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

ALCOHOL	SRTWD LSMEAN
BASE	4.43883854
ETOH	3.47152663
OXY	3.29099445

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
ALL DATA SORTED BY TEMP BY FUEL BY SYSTEM BY CAR

OBS	TEMPLEV	SYSTEM	VOL	ALCOHOL	ADJUST	DRIVER	CAR	RUN	FUEL	RVP	TVL20	TEMP	TWD	SRTWD
1	HIGH	CARB	LOW	BASE	BASE	4	1	9	1	10.1	136.0	88	0	0.0000
2	HIGH	CARB	LOW	BASE	BASE	4	1	13	1	10.1	136.0	90	31	5.5678
3	HIGH	CARB	LOW	BASE	BASE	3	3	8	1	10.1	136.0	86	31	5.5678
4	HIGH	CARB	LOW	BASE	BASE	3	3	14	1	10.1	136.0	90	37	6.0828
5	HIGH	CARB	LOW	BASE	BASE	2	4	10	1	10.1	136.0	86	61	7.8102
6	HIGH	CARB	LOW	BASE	BASE	2	4	16	1	10.1	136.0	90	120	10.9545
7	HIGH	CARB	LOW	BASE	BASE	3	7	5	1	10.1	136.0	92	130	11.4018
8	HIGH	CARB	LOW	BASE	BASE	1	10	6	1	10.1	136.0	86	0	0.0000
9	HIGH	CARB	LOW	BASE	BASE	1	10	10	1	10.1	136.0	90	0	0.0000
10	HIGH	CARB	LOW	BASE	BASE	4	11	7	1	10.1	136.0	85	57	7.5498
11	HIGH	CARB	LOW	BASE	BASE	4	11	11	1	10.1	136.0	90	32	5.6569
12	HIGH	PFI	LOW	BASE	BASE	4	5	12	1	10.1	136.0	92	13	3.6056
13	HIGH	PFI	LOW	BASE	BASE	2	6	8	1	10.1	136.0	85	0	0.0000
14	HIGH	PFI	LOW	BASE	BASE	2	6	12	1	10.1	136.0	90	6	2.4495
15	HIGH	PFI	LOW	BASE	BASE	1	13	1	1	10.1	136.0	85	0	0.0000
16	HIGH	PFI	LOW	BASE	BASE	1	13	4	1	10.1	136.0	90	0	0.0000
17	HIGH	TBI	LOW	BASE	BASE	2	2	6	1	10.1	136.0	92	0	0.0000
18	HIGH	TBI	LOW	BASE	BASE	1	8	11	1	10.1	136.0	92	10	3.1623
19	HIGH	TBI	LOW	BASE	BASE	1	8	17	1	10.1	136.0	91	9	3.0000
20	HIGH	TBI	LOW	BASE	BASE	3	9	9	1	10.1	136.0	85	50	7.0711
21	HIGH	TBI	LOW	BASE	BASE	3	9	11	1	10.1	136.0	90	34	5.8310
22	HIGH	CARB	LOW	OXY	MATCH	4	1	12	2	9.8	128.0	94	179	13.3791
23	HIGH	CARB	LOW	OXY	MATCH	4	1	16	2	9.8	128.0	89	33	5.7446
24	HIGH	CARB	LOW	OXY	MATCH	3	3	11	2	9.8	128.0	95	44	6.6332
25	HIGH	CARB	LOW	OXY	MATCH	2	4	12	2	9.8	128.0	94	139	11.7898
26	HIGH	CARB	LOW	OXY	MATCH	2	4	19	2	9.8	128.0	87	66	8.1240
27	HIGH	CARB	LOW	OXY	MATCH	3	7	6	2	9.8	128.0	90	161	12.6886
28	HIGH	CARB	LOW	OXY	MATCH	1	10	9	2	9.8	128.0	95	20	4.4721
29	HIGH	CARB	LOW	OXY	MATCH	4	11	10	2	9.8	128.0	94	168	12.9615
30	HIGH	CARB	LOW	OXY	MATCH	4	11	19	2	9.8	128.0	90	136	11.6619
31	HIGH	PFI	LOW	OXY	MATCH	4	5	7	2	9.8	128.0	90	8	2.8284
32	HIGH	PFI	LOW	OXY	MATCH	2	6	11	2	9.8	128.0	94	1	1.0000
33	HIGH	PFI	LOW	OXY	MATCH	1	13	5	2	9.8	128.0	91	0	0.0000
34	HIGH	TBI	LOW	OXY	MATCH	2	2	7	2	9.8	128.0	90	0	0.0000
35	HIGH	TBI	LOW	OXY	MATCH	1	8	12	2	9.8	128.0	90	9	3.0000
36	HIGH	TBI	LOW	OXY	MATCH	3	9	12	2	9.8	128.0	91	37	6.0828
37	HIGH	CARB	LOW	OXY	SPLASH	4	1	6	3	8.2	133.8	99	104	10.1980
38	HIGH	CARB	LOW	OXY	SPLASH	3	3	5	3	8.2	133.8	99	49	7.0000
39	HIGH	CARB	LOW	OXY	SPLASH	2	4	6	3	8.2	133.8	99	108	10.3923
40	HIGH	CARB	LOW	OXY	SPLASH	2	4	7	3	8.2	133.8	96	104	10.1980
41	HIGH	CARB	LOW	OXY	SPLASH	3	7	7	3	8.2	133.8	93	106	10.2956
42	HIGH	CARB	LOW	OXY	SPLASH	1	10	11	3	8.2	133.8	92	44	6.6332
43	HIGH	CARB	LOW	OXY	SPLASH	4	11	4	3	8.2	133.8	99	13	3.6056
44	HIGH	CARB	LOW	OXY	SPLASH	4	11	15	3	8.2	133.8	86	26	5.0990
45	HIGH	PFI	LOW	OXY	SPLASH	4	5	8	3	8.2	133.8	92	7	2.6458
46	HIGH	PFI	LOW	OXY	SPLASH	2	6	5	3	8.2	133.8	97	0	0.0000
47	HIGH	PFI	LOW	OXY	SPLASH	1	13	6	3	8.2	133.8	95	0	0.0000
48	HIGH	TBI	LOW	OXY	SPLASH	2	2	8	3	8.2	133.8	93	0	0.0000
49	HIGH	TBI	LOW	OXY	SPLASH	1	8	6	3	8.2	133.8	99	6	2.4495
50	HIGH	TBI	LOW	OXY	SPLASH	1	8	13	3	8.2	133.8	91	47	6.8557
51	HIGH	TBI	LOW	OXY	SPLASH	3	9	6	3	8.2	133.8	99	22	4.6904
52	HIGH	TBI	LOW	OXY	SPLASH	3	9	13	3	8.2	133.8	95	37	6.0828
53	HIGH	CARB	LOW	ETOH	MATCH	4	1	8	4	12.6	123.5	95	82	9.0554

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
ALL DATA SORTED BY TEMP BY FUEL BY SYSTEM BY CAR

OBS	TEMPLEV	SYSTEM	VOL	ALCOHOL	ADJUST	DRIVER	CAR	RUN	FUEL	RVP	TVL20	TEMP	TWD	SRTWD
54	HIGH	CARB	LOW	ETOH	MATCH	3	3	7	4	12.6	123.5	95	125	11.1803
55	HIGH	CARB	LOW	ETOH	MATCH	3	3	16	4	12.6	123.5	88	16	4.0000
56	HIGH	CARB	LOW	ETOH	MATCH	2	4	9	4	12.6	123.5	95	118	10.8628
57	HIGH	CARB	LOW	ETOH	MATCH	2	4	18	4	12.6	123.5	88	88	9.3808
58	HIGH	CARB	LOW	ETOH	MATCH	3	7	2	4	12.6	123.5	96	213	14.5945
59	HIGH	CARB	LOW	ETOH	MATCH	1	10	5	4	12.6	123.5	95	4	2.0000
60	HIGH	CARB	LOW	ETOH	MATCH	4	11	6	4	12.6	123.5	95	132	11.4891
61	HIGH	PFI	LOW	ETOH	MATCH	4	5	5	4	12.6	123.5	96	12	3.4641
62	HIGH	PFI	LOW	ETOH	MATCH	2	6	7	4	12.6	123.5	95	8	2.8284
63	HIGH	PFI	LOW	ETOH	MATCH	1	13	10	4	12.6	123.5	87	0	0.0000
64	HIGH	TBI	LOW	ETOH	MATCH	2	2	4	4	12.6	123.5	96	12	3.4641
65	HIGH	TBI	LOW	ETOH	MATCH	1	8	8	4	12.6	123.5	95	0	0.0000
66	HIGH	TBI	LOW	ETOH	MATCH	3	9	8	4	12.6	123.5	95	85	9.2195
67	HIGH	CARB	LOW	ETOH	SPLASH	4	1	3	5	9.0	132.5	97	42	6.4807
68	HIGH	CARB	LOW	ETOH	SPLASH	4	1	15	5	9.0	132.5	94	39	6.2450
69	HIGH	CARB	LOW	ETOH	SPLASH	3	3	3	5	9.0	132.5	97	28	5.2915
70	HIGH	CARB	LOW	ETOH	SPLASH	3	3	13	5	9.0	132.5	94	52	7.2111
71	HIGH	CARB	LOW	ETOH	SPLASH	2	4	3	5	9.0	132.5	97	55	7.4162
72	HIGH	CARB	LOW	ETOH	SPLASH	2	4	14	5	9.0	132.5	95	73	8.5440
73	HIGH	CARB	LOW	ETOH	SPLASH	3	7	8	5	9.0	132.5	95	177	13.3041
74	HIGH	CARB	LOW	ETOH	SPLASH	1	10	14	5	9.0	132.5	86	18	4.2426
75	HIGH	CARB	LOW	ETOH	SPLASH	1	10	15	5	9.0	132.5	87	22	4.6904
76	HIGH	CARB	LOW	ETOH	SPLASH	4	11	2	5	9.0	132.5	97	35	5.9161
77	HIGH	CARB	LOW	ETOH	SPLASH	4	11	13	5	9.0	132.5	90	36	6.0000
78	HIGH	PFI	LOW	ETOH	SPLASH	4	5	11	5	9.0	132.5	93	42	6.4807
79	HIGH	PFI	LOW	ETOH	SPLASH	2	6	3	5	9.0	132.5	96	0	0.0000
80	HIGH	PFI	LOW	ETOH	SPLASH	1	13	7	5	9.0	132.5	90	0	0.0000
81	HIGH	TBI	LOW	ETOH	SPLASH	2	2	9	5	9.0	132.5	93	1	1.0000
82	HIGH	TBI	LOW	ETOH	SPLASH	1	8	4	5	9.0	132.5	96	1	1.0000
83	HIGH	TBI	LOW	ETOH	SPLASH	1	8	14	5	9.0	132.5	94	64	8.0000
84	HIGH	TBI	LOW	ETOH	SPLASH	3	9	4	5	9.0	132.5	96	46	6.7823
85	HIGH	TBI	LOW	ETOH	SPLASH	3	9	14	5	9.0	132.5	94	21	4.5826
86	HIGH	CARB	MEDIUM	BASE	BASE	4	1	1	6	15.7	103.7	88	168	12.9615
87	HIGH	CARB	MEDIUM	BASE	BASE	4	1	10	6	15.7	103.7	92	231	15.1987
88	HIGH	CARB	MEDIUM	BASE	BASE	3	3	9	6	15.7	103.7	93	403	20.0749
89	HIGH	CARB	MEDIUM	BASE	BASE	3	3	18	6	15.7	103.7	87	293	17.1172
90	HIGH	CARB	MEDIUM	BASE	BASE	2	4	1	6	15.7	103.7	90	106	10.2956
91	HIGH	CARB	MEDIUM	BASE	BASE	2	4	17	6	15.7	103.7	91	237	15.3948
92	HIGH	CARB	MEDIUM	BASE	BASE	2	4	21	6	15.7	103.7	87	106	10.2956
93	HIGH	CARB	MEDIUM	BASE	BASE	3	7	3	6	15.7	103.7	90	165	12.8452
94	HIGH	CARB	MEDIUM	BASE	BASE	3	7	14	6	15.7	103.7	90	118	10.8628
95	HIGH	CARB	MEDIUM	BASE	BASE	1	10	1	6	15.7	103.7	90	36	6.0000
96	HIGH	CARB	MEDIUM	BASE	BASE	1	10	7	6	15.7	103.7	91	20	4.4721
97	HIGH	CARB	MEDIUM	BASE	BASE	4	11	8	6	15.7	103.7	91	112	10.5830
98	HIGH	CARB	MEDIUM	BASE	BASE	4	11	18	6	15.7	103.7	87	113	10.6301
99	HIGH	PFI	MEDIUM	BASE	BASE	4	5	1	6	15.7	103.7	90	0	0.0000
100	HIGH	PFI	MEDIUM	BASE	BASE	3	6	1	6	15.7	103.7	90	13	3.6056
101	HIGH	PFI	MEDIUM	BASE	BASE	2	6	9	6	15.7	103.7	92	6	2.4495
102	HIGH	PFI	MEDIUM	BASE	BASE	1	13	2	6	15.7	103.7	90	0	0.0000
103	HIGH	TBI	MEDIUM	BASE	BASE	2	2	1	6	15.7	103.7	90	8	2.8284
104	HIGH	TBI	MEDIUM	BASE	BASE	1	8	1	6	15.7	103.7	88	24	4.8990
105	HIGH	TBI	MEDIUM	BASE	BASE	1	8	9	6	15.7	103.7	92	51	7.1414
106	HIGH	TBI	MEDIUM	BASE	BASE	1	8	16	6	15.7	103.7	87	43	6.5574

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
ALL DATA SORTED BY TEMP BY FUEL BY SYSTEM BY CAR

OBS	TEMPLEV	SYSTEM	VOL	ALCOHOL	ADJUST	DRIVER	CAR	RUN	FUEL	RVP	TVL20	TEMP	TWD	SRTWD
107	HIGH	TBI	MEDIUM	BASE	BASE	3	9	1	6	15.7	103.7	90	75	8.6603
108	HIGH	TBI	MEDIUM	BASE	BASE	3	9	16	6	15.7	103.7	90	63	7.9373
109	HIGH	CARB	MEDIUM	OXY	MATCH	4	1	7	7	15.9	102.3	92	232	15.2315
110	HIGH	CARB	MEDIUM	OXY	MATCH	3	3	6	7	15.9	102.3	94	201	14.1774
111	HIGH	CARB	MEDIUM	OXY	MATCH	2	4	8	7	15.9	102.3	90	237	15.3948
112	HIGH	CARB	MEDIUM	OXY	MATCH	3	7	10	7	15.9	102.3	95	139	11.7898
113	HIGH	CARB	MEDIUM	OXY	MATCH	1	10	4	7	15.9	102.3	90	5	2.2361
114	HIGH	CARB	MEDIUM	OXY	MATCH	4	11	5	7	15.9	102.3	97	156	12.4900
115	HIGH	PFI	MEDIUM	OXY	MATCH	4	5	4	7	15.9	102.3	96	61	7.8102
116	HIGH	PFI	MEDIUM	OXY	MATCH	2	6	6	7	15.9	102.3	94	4	2.0000
117	HIGH	PFI	MEDIUM	OXY	MATCH	1	13	9	7	15.9	102.3	94	0	0.0000
118	HIGH	TBI	MEDIUM	OXY	MATCH	2	2	11	7	15.9	102.3	94	43	6.5574
119	HIGH	TBI	MEDIUM	OXY	MATCH	2	2	12	7	15.9	102.3	89	10	3.1623
120	HIGH	TBI	MEDIUM	OXY	MATCH	1	8	7	7	15.9	102.3	96	27	5.1962
121	HIGH	TBI	MEDIUM	OXY	MATCH	3	9	7	7	15.9	102.3	90	126	11.2250
122	HIGH	CARB	MEDIUM	OXY	SPLASH	4	1	2	8	15.0	104.7	88	225	15.0000
123	HIGH	CARB	MEDIUM	OXY	SPLASH	4	1	5	8	15.0	104.7	94	197	14.0357
124	HIGH	CARB	MEDIUM	OXY	SPLASH	3	3	1	8	15.0	104.7	88	166	12.8841
125	HIGH	CARB	MEDIUM	OXY	SPLASH	3	3	4	8	15.0	104.7	94	157	12.5300
126	HIGH	CARB	MEDIUM	OXY	SPLASH	3	3	15	8	15.0	104.7	88	179	13.3791
127	HIGH	CARB	MEDIUM	OXY	SPLASH	2	4	5	8	15.0	104.7	94	242	15.5563
128	HIGH	CARB	MEDIUM	OXY	SPLASH	2	4	13	8	15.0	104.7	90	218	14.7648
129	HIGH	CARB	MEDIUM	OXY	SPLASH	3	7	9	8	15.0	104.7	90	221	14.8661
130	HIGH	CARB	MEDIUM	OXY	SPLASH	1	10	2	8	15.0	104.7	87	9	3.0000
131	HIGH	CARB	MEDIUM	OXY	SPLASH	1	10	12	8	15.0	104.7	90	51	7.1414
132	HIGH	CARB	MEDIUM	OXY	SPLASH	4	11	3	8	15.0	104.7	93	48	6.9282
133	HIGH	PFI	MEDIUM	OXY	SPLASH	4	5	2	8	15.0	104.7	87	13	3.6056
134	HIGH	PFI	MEDIUM	OXY	SPLASH	4	5	9	8	15.0	104.7	90	8	2.8284
135	HIGH	PFI	MEDIUM	OXY	SPLASH	2	6	4	8	15.0	104.7	94	16	4.0000
136	HIGH	PFI	MEDIUM	OXY	SPLASH	2	6	13	8	15.0	104.7	95	12	3.4641
137	HIGH	PFI	MEDIUM	OXY	SPLASH	1	13	8	8	15.0	104.7	94	0	0.0000
138	HIGH	TBI	MEDIUM	OXY	SPLASH	2	2	2	8	15.0	104.7	88	0	0.0000
139	HIGH	TBI	MEDIUM	OXY	SPLASH	2	2	10	8	15.0	104.7	90	10	3.1623
140	HIGH	TBI	MEDIUM	OXY	SPLASH	1	8	5	8	15.0	104.7	93	13	3.6056
141	HIGH	TBI	MEDIUM	OXY	SPLASH	3	9	2	8	15.0	104.7	88	87	9.3274
142	HIGH	TBI	MEDIUM	OXY	SPLASH	3	9	5	8	15.0	104.7	93	77	8.7750
143	HIGH	CARB	MEDIUM	ETOH	MATCH	4	1	11	9	16.2	102.3	90	205	14.3178
144	HIGH	CARB	MEDIUM	ETOH	MATCH	3	3	10	9	16.2	102.3	90	338	18.3848
145	HIGH	CARB	MEDIUM	ETOH	MATCH	2	4	11	9	16.2	102.3	90	162	12.7279
146	HIGH	CARB	MEDIUM	ETOH	MATCH	3	7	4	9	16.2	102.3	94	164	12.8062
147	HIGH	CARB	MEDIUM	ETOH	MATCH	1	10	8	9	16.2	102.3	90	45	6.7082
148	HIGH	CARB	MEDIUM	ETOH	MATCH	4	11	9	9	16.2	102.3	91	152	12.3288
149	HIGH	PFI	MEDIUM	ETOH	MATCH	4	5	6	9	16.2	102.3	92	33	5.7446
150	HIGH	PFI	MEDIUM	ETOH	MATCH	2	6	10	9	16.2	102.3	92	7	2.6458
151	HIGH	PFI	MEDIUM	ETOH	MATCH	1	13	3	9	16.2	102.3	94	16	4.0000
152	HIGH	TBI	MEDIUM	ETOH	MATCH	2	2	5	9	16.2	102.3	94	2	1.4142
153	HIGH	TBI	MEDIUM	ETOH	MATCH	1	8	10	9	16.2	102.3	92	25	5.0000
154	HIGH	TBI	MEDIUM	ETOH	MATCH	3	9	10	9	16.2	102.3	92	110	10.4881
155	HIGH	CARB	MEDIUM	ETOH	SPLASH	4	1	4	10	15.2	104.5	95	211	14.5258
156	HIGH	CARB	MEDIUM	ETOH	SPLASH	4	1	17	10	15.2	104.5	86	172	13.1149
157	HIGH	CARB	MEDIUM	ETOH	SPLASH	4	1	18	10	15.2	104.5	87	144	12.0000
158	HIGH	CARB	MEDIUM	ETOH	SPLASH	3	3	2	10	15.2	104.5	95	191	13.8203
159	HIGH	CARB	MEDIUM	ETOH	SPLASH	3	3	17	10	15.2	104.5	87	107	10.3441

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
ALL DATA SORTED BY TEMP BY FUEL BY SYSTEM BY CAR

OBS	TEMPLEV	SYSTEM	VOL	ALCOHOL	ADJUST	DRIVER	CAR	RUN	FUEL	RVP	TVL20	TEMP	TWD	SRTWD
160	HIGH	CARB	MEDIUM	ETOH	SPLASH	2	4	4	10	15.2	104.5	95	266	16.3095
161	HIGH	CARB	MEDIUM	ETOH	SPLASH	2	4	20	10	15.2	104.5	87	108	10.3923
162	HIGH	CARB	MEDIUM	ETOH	SPLASH	3	7	1	10	15.2	104.5	97	112	10.5830
163	HIGH	CARB	MEDIUM	ETOH	SPLASH	3	7	11	10	15.2	104.5	89	140	11.8322
164	HIGH	CARB	MEDIUM	ETOH	SPLASH	3	7	12	10	15.2	104.5	87	102	10.0995
165	HIGH	CARB	MEDIUM	ETOH	SPLASH	1	10	3	10	15.2	104.5	96	24	4.8990
166	HIGH	CARB	MEDIUM	ETOH	SPLASH	1	10	13	10	15.2	104.5	87	21	4.5826
167	HIGH	CARB	MEDIUM	ETOH	SPLASH	4	11	1	10	15.2	104.5	91	66	8.1240
168	HIGH	CARB	MEDIUM	ETOH	SPLASH	4	11	14	10	15.2	104.5	94	42	6.4807
169	HIGH	CARB	MEDIUM	ETOH	SPLASH	4	11	17	10	15.2	104.5	87	102	10.0995
170	HIGH	PFI	MEDIUM	ETOH	SPLASH	4	5	3	10	15.2	104.5	96	92	9.5917
171	HIGH	PFI	MEDIUM	ETOH	SPLASH	2	6	2	10	15.2	104.5	93	4	2.0000
172	HIGH	PFI	MEDIUM	ETOH	SPLASH	2	6	15	10	15.2	104.5	87	1	1.0000
173	HIGH	PFI	MEDIUM	ETOH	SPLASH	1	13	11	10	15.2	104.5	87	0	0.0000
174	HIGH	TBI	MEDIUM	ETOH	SPLASH	2	2	3	10	15.2	104.5	96	10	3.1623
175	HIGH	TBI	MEDIUM	ETOH	SPLASH	1	8	3	10	15.2	104.5	93	95	9.7468
176	HIGH	TBI	MEDIUM	ETOH	SPLASH	1	8	15	10	15.2	104.5	88	29	5.3852
177	HIGH	TBI	MEDIUM	ETOH	SPLASH	3	9	3	10	15.2	104.5	91	55	7.4162
178	HIGH	TBI	MEDIUM	ETOH	SPLASH	3	9	15	10	15.2	104.5	87	99	9.9499
179	HIGH	CARB	MEDIUM	OXY	MATCH	4	1	19	11	0.0	0.0	91	167	12.9228
180	HIGH	CARB	MEDIUM	OXY	MATCH	2	4	22	11	0.0	0.0	90	131	11.4455
181	HIGH	CARB	MEDIUM	OXY	MATCH	3	7	13	11	0.0	0.0	91	117	10.8167
182	HIGH	CARB	MEDIUM	OXY	MATCH	1	10	16	11	0.0	0.0	91	40	6.3246
183	HIGH	CARB	MEDIUM	OXY	MATCH	1	10	17	11	0.0	0.0	91	21	4.5826
184	HIGH	PFI	MEDIUM	OXY	MATCH	2	6	14	11	0.0	0.0	94	2	1.4142
185	HIGH	PFI	MEDIUM	OXY	MATCH	2	6	16	11	0.0	0.0	91	1	1.0000
186	HIGH	TBI	MEDIUM	OXY	MATCH	2	2	13	11	0.0	0.0	87	11	3.3166
187	HIGH	PFI	MEDIUM	OXY	MATCH	4	5	10	12	0.0	0.0	94	0	0.0000
188	HIGH	CARB	MEDIUM	OXY	MATCH	4	1	14	13	9.0	132.5	91	137	11.7047
189	HIGH	CARB	MEDIUM	OXY	MATCH	3	3	12	13	9.0	132.5	90	124	11.1355
190	HIGH	CARB	MEDIUM	OXY	MATCH	2	4	15	13	9.0	132.5	91	88	9.3808
191	HIGH	CARB	MEDIUM	OXY	MATCH	4	11	12	13	9.0	132.5	95	106	10.2956
192	HIGH	CARB	MEDIUM	OXY	MATCH	4	11	16	13	9.0	132.5	87	158	12.5698
193	MEDIUM	CARB	LOW	BASE	BASE	4	1	8	1	10.1	136.0	69	7	2.6458
194	MEDIUM	CARB	LOW	BASE	BASE	3	3	5	1	10.1	136.0	68	18	4.2426
195	MEDIUM	CARB	LOW	BASE	BASE	3	3	6	1	10.1	136.0	74	124	11.1355
196	MEDIUM	CARB	LOW	BASE	BASE	2	4	8	1	10.1	136.0	66	24	4.8990
197	MEDIUM	CARB	LOW	BASE	BASE	2	4	9	1	10.1	136.0	74	84	9.1652
198	MEDIUM	CARB	LOW	BASE	BASE	2	7	5	1	10.1	136.0	71	18	4.2426
199	MEDIUM	CARB	LOW	BASE	BASE	1	10	6	1	10.1	136.0	71	4	2.0000
200	MEDIUM	CARB	LOW	BASE	BASE	4	11	4	1	10.1	136.0	69	132	11.4891
201	MEDIUM	CARB	LOW	BASE	BASE	4	11	5	1	10.1	136.0	72	94	9.6954
202	MEDIUM	PFI	LOW	BASE	BASE	3	6	8	1	10.1	136.0	71	4	2.0000
203	MEDIUM	PFI	LOW	BASE	BASE	1	13	5	1	10.1	136.0	69	8	2.8284
204	MEDIUM	PFI	LOW	BASE	BASE	1	13	6	1	10.1	136.0	74	8	2.8284
205	MEDIUM	CARB	LOW	ETOH	SPLASH	4	1	1	5	9.0	132.5	74	0	0.0000
206	MEDIUM	CARB	LOW	ETOH	SPLASH	2	4	1	5	9.0	132.5	74	0	0.0000
207	MEDIUM	PFI	LOW	ETOH	SPLASH	3	6	1	5	9.0	132.5	78	0	0.0000
208	MEDIUM	TBI	LOW	ETOH	SPLASH	1	8	1	5	9.0	132.5	74	16	4.0000
209	MEDIUM	CARB	MEDIUM	BASE	BASE	4	1	2	6	15.7	103.7	79	97	9.8489
210	MEDIUM	CARB	MEDIUM	BASE	BASE	4	1	7	6	15.7	103.7	75	211	14.5258
211	MEDIUM	CARB	MEDIUM	BASE	BASE	3	3	4	6	15.7	103.7	71	176	13.2665
212	MEDIUM	CARB	MEDIUM	BASE	BASE	2	4	2	6	15.7	103.7	79	52	7.2111

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
ALL DATA SORTED BY TEMP BY FUEL BY SYSTEM BY CAR

OBS	TEMPLEV	SYSTEM	VOL	ALCOHOL	ADJUST	DRIVER	CAR	RUN	FUEL	RVP	TVL20	TEMP	TWD	SRTWD
213	MEDIUM	CARB	MEDIUM	BASE	BASE	2	4	7	6	15.7	103.7	71	32	5.6569
214	MEDIUM	CARB	MEDIUM	BASE	BASE	2	7	4	6	15.7	103.7	75	32	5.6569
215	MEDIUM	CARB	MEDIUM	BASE	BASE	1	10	1	6	15.7	103.7	74	9	3.0000
216	MEDIUM	CARB	MEDIUM	BASE	BASE	1	10	7	6	15.7	103.7	71	16	4.0000
217	MEDIUM	CARB	MEDIUM	BASE	BASE	4	11	6	6	15.7	103.7	71	117	10.8167
218	MEDIUM	PFI	MEDIUM	BASE	BASE	4	5	1	6	15.7	103.7	75	0	0.0000
219	MEDIUM	PFI	MEDIUM	BASE	BASE	3	6	2	6	15.7	103.7	77	28	5.2915
220	MEDIUM	PFI	MEDIUM	BASE	BASE	3	6	7	6	15.7	103.7	75	9	3.0000
221	MEDIUM	PFI	MEDIUM	BASE	BASE	1	13	4	6	15.7	103.7	75	28	5.2915
222	MEDIUM	TBI	MEDIUM	BASE	BASE	2	2	1	6	15.7	103.7	74	0	0.0000
223	MEDIUM	TBI	MEDIUM	BASE	BASE	1	8	2	6	15.7	103.7	77	8	2.8284
224	MEDIUM	TBI	MEDIUM	BASE	BASE	3	9	1	6	15.7	103.7	74	110	10.4881
225	MEDIUM	CARB	MEDIUM	OXY	MATCH	4	1	6	7	15.9	102.3	79	207	14.3875
226	MEDIUM	CARB	MEDIUM	OXY	MATCH	2	4	6	7	15.9	102.3	79	200	14.1421
227	MEDIUM	CARB	MEDIUM	OXY	MATCH	1	10	5	7	15.9	102.3	74	30	5.4772
228	MEDIUM	PFI	MEDIUM	OXY	MATCH	4	5	5	7	15.9	102.3	74	19	4.3589
229	MEDIUM	PFI	MEDIUM	OXY	MATCH	3	6	6	7	15.9	102.3	79	9	3.0000
230	MEDIUM	TBI	MEDIUM	OXY	MATCH	2	2	5	7	15.9	102.3	74	3	1.7321
231	MEDIUM	TBI	MEDIUM	OXY	MATCH	1	8	6	7	15.9	102.3	79	56	7.4833
232	MEDIUM	TBI	MEDIUM	OXY	MATCH	3	9	4	7	15.9	102.3	76	24	4.8990
233	MEDIUM	CARB	MEDIUM	OXY	SPLASH	4	1	3	8	15.0	104.7	75	98	9.8995
234	MEDIUM	CARB	MEDIUM	OXY	SPLASH	3	3	1	8	15.0	104.7	74	49	7.0000
235	MEDIUM	CARB	MEDIUM	OXY	SPLASH	2	4	3	8	15.0	104.7	76	21	4.5826
236	MEDIUM	CARB	MEDIUM	OXY	SPLASH	2	7	1	8	15.0	104.7	74	20	4.4721
237	MEDIUM	CARB	MEDIUM	OXY	SPLASH	1	10	2	8	15.0	104.7	77	19	4.3589
238	MEDIUM	CARB	MEDIUM	OXY	SPLASH	4	11	1	8	15.0	104.7	74	91	9.5394
239	MEDIUM	PFI	MEDIUM	OXY	SPLASH	4	5	2	8	15.0	104.7	77	0	0.0000
240	MEDIUM	PFI	MEDIUM	OXY	SPLASH	3	6	3	8	15.0	104.7	74	12	3.4641
241	MEDIUM	PFI	MEDIUM	OXY	SPLASH	1	13	1	8	15.0	104.7	76	0	0.0000
242	MEDIUM	TBI	MEDIUM	OXY	SPLASH	2	2	2	8	15.0	104.7	74	1	1.0000
243	MEDIUM	TBI	MEDIUM	OXY	SPLASH	1	8	3	8	15.0	104.7	75	15	3.8730
244	MEDIUM	TBI	MEDIUM	OXY	SPLASH	3	9	2	8	15.0	104.7	76	25	5.0000
245	MEDIUM	CARB	MEDIUM	ETOH	MATCH	4	1	5	9	16.2	102.3	58	61	7.8102
246	MEDIUM	CARB	MEDIUM	ETOH	MATCH	3	3	3	9	16.2	102.3	63	97	9.8489
247	MEDIUM	CARB	MEDIUM	ETOH	MATCH	2	4	5	9	16.2	102.3	58	38	6.1644
248	MEDIUM	CARB	MEDIUM	ETOH	MATCH	2	7	3	9	16.2	102.3	62	8	2.8284
249	MEDIUM	CARB	MEDIUM	ETOH	MATCH	1	10	4	9	16.2	102.3	59	28	5.2915
250	MEDIUM	CARB	MEDIUM	ETOH	MATCH	4	11	3	9	16.2	102.3	62	154	12.4097
251	MEDIUM	PFI	MEDIUM	ETOH	MATCH	4	5	4	9	16.2	102.3	83	6	2.4495
252	MEDIUM	PFI	MEDIUM	ETOH	MATCH	3	6	5	9	16.2	102.3	58	1	1.0000
253	MEDIUM	PFI	MEDIUM	ETOH	MATCH	1	13	3	9	16.2	102.3	61	1	1.0000
254	MEDIUM	TBI	MEDIUM	ETOH	MATCH	2	2	4	9	16.2	102.3	83	8	2.8284
255	MEDIUM	TBI	MEDIUM	ETOH	MATCH	1	8	5	9	16.2	102.3	83	8	2.8284
256	MEDIUM	TBI	MEDIUM	ETOH	MATCH	3	9	5	9	16.2	102.3	74	45	6.7082
257	MEDIUM	CARB	MEDIUM	ETOH	SPLASH	4	1	4	10	15.2	104.5	79	150	12.2474
258	MEDIUM	CARB	MEDIUM	ETOH	SPLASH	3	3	2	10	15.2	104.5	81	94	9.6954
259	MEDIUM	CARB	MEDIUM	ETOH	SPLASH	2	4	4	10	15.2	104.5	79	83	9.1104
260	MEDIUM	CARB	MEDIUM	ETOH	SPLASH	2	7	2	10	15.2	104.5	81	0	0.0000
261	MEDIUM	CARB	MEDIUM	ETOH	SPLASH	1	10	3	10	15.2	104.5	83	13	3.6056
262	MEDIUM	CARB	MEDIUM	ETOH	SPLASH	4	11	2	10	15.2	104.5	83	41	6.4031
263	MEDIUM	PFI	MEDIUM	ETOH	SPLASH	4	5	3	10	15.2	104.5	76	10	3.1623
264	MEDIUM	PFI	MEDIUM	ETOH	SPLASH	3	6	4	10	15.2	104.5	79	1	1.0000
265	MEDIUM	PFI	MEDIUM	ETOH	SPLASH	1	13	2	10	15.2	104.5	79	0	0.0000

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
ALL DATA SORTED BY TEMP BY FUEL BY SYSTEM BY CAR

OBS	TEMPLEV	SYSTEM	VOL	ALCOHOL	ADJUST	DRIVER	CAR	RUN	FUEL	RVP	TVL20	TEMP	TWD	SRTWD
266	MEDIUM	TBI	MEDIUM	ETOH	SPLASH	2	2	3	10	15.2	104.5	78	0	0.0000
267	MEDIUM	TBI	MEDIUM	ETOH	SPLASH	1	8	4	10	15.2	104.5	76	12	3.4641
268	MEDIUM	TBI	MEDIUM	ETOH	SPLASH	3	9	3	10	15.2	104.5	83	25	5.0000

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
AVERAGE TWD FOR EACH CAR BY TEMP BY FUEL BY SYSTEM

OBS	TEMPLEV	FUEL	SYSTEM	CAR	TWDM	SRTWDM
1	HIGH	1	CARB	1	15.5	2.7839
2	HIGH	1	CARB	3	34.0	5.8253
3	HIGH	1	CARB	4	90.5	9.3824
4	HIGH	1	CARB	7	130.0	11.4018
5	HIGH	1	CARB	10	0.0	0.0000
6	HIGH	1	CARB	11	44.5	6.6833
7	HIGH	1	PFI	5	13.0	3.6056
8	HIGH	1	PFI	6	3.0	1.2247
9	HIGH	1	PFI	13	0.0	0.0000
10	HIGH	1	TBI	2	0.0	0.0000
11	HIGH	1	TBI	8	9.5	3.0811
12	HIGH	1	TBI	9	42.0	6.4510
13	HIGH	2	CARB	1	106.0	9.5618
14	HIGH	2	CARB	3	44.0	6.6332
15	HIGH	2	CARB	4	102.5	9.9569
16	HIGH	2	CARB	7	161.0	12.6886
17	HIGH	2	CARB	10	20.0	4.4721
18	HIGH	2	CARB	11	152.0	12.3117
19	HIGH	2	PFI	5	8.0	2.8284
20	HIGH	2	PFI	6	1.0	1.0000
21	HIGH	2	PFI	13	0.0	0.0000
22	HIGH	2	TBI	2	0.0	0.0000
23	HIGH	2	TBI	8	9.0	3.0000
24	HIGH	2	TBI	9	37.0	6.0828
25	HIGH	3	CARB	1	104.0	10.1980
26	HIGH	3	CARB	3	49.0	7.0000
27	HIGH	3	CARB	4	106.0	10.2952
28	HIGH	3	CARB	7	106.0	10.2956
29	HIGH	3	CARB	10	44.0	6.6332
30	HIGH	3	CARB	11	19.5	4.3523
31	HIGH	3	PFI	5	7.0	2.6458
32	HIGH	3	PFI	6	0.0	0.0000
33	HIGH	3	PFI	13	0.0	0.0000
34	HIGH	3	TBI	2	0.0	0.0000
35	HIGH	3	TBI	8	26.5	4.6526
36	HIGH	3	TBI	9	29.5	5.3866
37	HIGH	4	CARB	1	82.0	9.0554
38	HIGH	4	CARB	3	70.5	7.5902
39	HIGH	4	CARB	4	103.0	10.1218
40	HIGH	4	CARB	7	213.0	14.5945
41	HIGH	4	CARB	10	4.0	2.0000
42	HIGH	4	CARB	11	132.0	11.4891
43	HIGH	4	PFI	5	12.0	3.4641
44	HIGH	4	PFI	6	8.0	2.8284
45	HIGH	4	PFI	13	0.0	0.0000
46	HIGH	4	TBI	2	12.0	3.4641
47	HIGH	4	TBI	8	0.0	0.0000
48	HIGH	4	TBI	9	85.0	9.2195
49	HIGH	5	CARB	1	40.5	6.3629
50	HIGH	5	CARB	3	40.0	6.2513
51	HIGH	5	CARB	4	64.0	7.9801
52	HIGH	5	CARB	7	177.0	13.3041
53	HIGH	5	CARB	10	20.0	4.4665
54	HIGH	5	CARB	11	35.5	5.9580

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
AVERAGE TWD FOR EACH CAR BY TEMP BY FUEL BY SYSTEM

OBS	TEMPLEV	FUEL	SYSTEM	CAR	TWDM	SRTWDM
55	HIGH	5	PFI	5	42.000	6.4807
56	HIGH	5	PFI	6	0.000	0.0000
57	HIGH	5	PFI	13	0.000	0.0000
58	HIGH	5	TBI	2	1.000	1.0000
59	HIGH	5	TBI	8	32.500	4.5000
60	HIGH	5	TBI	9	33.500	5.6825
61	HIGH	6	CARB	1	199.500	14.0801
62	HIGH	6	CARB	3	348.000	18.5061
63	HIGH	6	CARB	4	140.667	11.9954
64	HIGH	6	CARB	7	141.500	11.8540
65	HIGH	6	CARB	10	28.000	5.2361
66	HIGH	6	CARB	11	112.500	10.6066
67	HIGH	6	PFI	5	0.000	0.0000
68	HIGH	6	PFI	6	9.500	3.0275
69	HIGH	6	PFI	13	0.000	0.0000
70	HIGH	6	TBI	2	8.000	2.8284
71	HIGH	6	TBI	8	39.333	6.1993
72	HIGH	6	TBI	9	69.000	8.2988
73	HIGH	7	CARB	1	232.000	15.2315
74	HIGH	7	CARB	3	201.000	14.1774
75	HIGH	7	CARB	4	237.000	15.3948
76	HIGH	7	CARB	7	139.000	11.7898
77	HIGH	7	CARB	10	5.000	2.2361
78	HIGH	7	CARB	11	156.000	12.4900
79	HIGH	7	PFI	5	61.000	7.8102
80	HIGH	7	PFI	6	4.000	2.0000
81	HIGH	7	PFI	13	0.000	0.0000
82	HIGH	7	TBI	2	26.500	4.8599
83	HIGH	7	TBI	8	27.000	5.1962
84	HIGH	7	TBI	9	126.000	11.2250
85	HIGH	8	CARB	1	211.000	14.5178
86	HIGH	8	CARB	3	167.333	12.9311
87	HIGH	8	CARB	4	230.000	15.1606
88	HIGH	8	CARB	7	221.000	14.8661
89	HIGH	8	CARB	10	30.000	5.0707
90	HIGH	8	CARB	11	48.000	6.9282
91	HIGH	8	PFI	5	10.500	3.2170
92	HIGH	8	PFI	6	14.000	3.7321
93	HIGH	8	PFI	13	0.000	0.0000
94	HIGH	8	TBI	2	5.000	1.5811
95	HIGH	8	TBI	8	13.000	3.6056
96	HIGH	8	TBI	9	82.000	9.0512
97	HIGH	9	CARB	1	205.000	14.3178
98	HIGH	9	CARB	3	338.000	18.3848
99	HIGH	9	CARB	4	162.000	12.7279
100	HIGH	9	CARB	7	164.000	12.8062
101	HIGH	9	CARB	10	45.000	6.7082
102	HIGH	9	CARB	11	152.000	12.3288
103	HIGH	9	PFI	5	33.000	5.7446
104	HIGH	9	PFI	6	7.000	2.6458
105	HIGH	9	PFI	13	16.000	4.0000
106	HIGH	9	TBI	2	2.000	1.4142
107	HIGH	9	TBI	8	25.000	5.0000
108	HIGH	9	TBI	9	110.000	10.4881

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
AVERAGE TWD FOR EACH CAR BY TEMP BY FUEL BY SYSTEM

OBS	TEMPLEV	FUEL	SYSTEM	CAR	TWDM	SRTWDM
109	HIGH	10	CARB	1	175.667	13.2136
110	HIGH	10	CARB	3	140.000	12.0822
111	HIGH	10	CARB	4	187.000	13.3509
112	HIGH	10	CARB	7	118.000	10.8382
113	HIGH	10	CARB	10	22.500	4.7408
114	HIGH	10	CARB	11	70.000	8.2348
115	HIGH	10	PFI	5	92.000	9.5917
116	HIGH	10	PFI	6	2.500	1.5000
117	HIGH	10	PFI	13	0.000	0.0000
118	HIGH	10	TBI	2	10.000	3.1623
119	HIGH	10	TBI	8	62.000	7.5660
120	HIGH	10	TBI	9	77.000	8.6830
121	HIGH	11	CARB	1	167.000	12.9228
122	HIGH	11	CARB	4	131.000	11.4455
123	HIGH	11	CARB	7	117.000	10.8167
124	HIGH	11	CARB	10	30.500	5.4536
125	HIGH	11	PFI	6	1.500	1.2071
126	HIGH	11	TBI	2	11.000	3.3166
127	HIGH	12	PFI	5	0.000	0.0000
128	HIGH	13	CARB	1	137.000	11.7047
129	HIGH	13	CARB	3	124.000	11.1355
130	HIGH	13	CARB	4	88.000	9.3806
131	HIGH	13	CARB	11	132.000	11.4327
132	MEDIUM	1	CARB	1	7.000	2.6458
133	MEDIUM	1	CARB	3	71.000	7.6801
134	MEDIUM	1	CARB	4	54.000	7.0321
135	MEDIUM	1	CARB	7	18.000	4.2426
136	MEDIUM	1	CARB	10	4.000	2.0000
137	MEDIUM	1	CARB	11	113.000	10.5922
138	MEDIUM	1	PFI	6	4.000	2.0000
139	MEDIUM	1	PFI	13	8.000	2.8284
140	MEDIUM	5	CARB	1	0.000	0.0000
141	MEDIUM	5	CARB	4	0.000	0.0000
142	MEDIUM	5	PFI	6	0.000	0.0000
143	MEDIUM	5	TBI	8	16.000	4.0000
144	MEDIUM	6	CARB	1	154.000	12.1873
145	MEDIUM	6	CARB	3	176.000	13.2665
146	MEDIUM	6	CARB	4	42.000	6.4340
147	MEDIUM	6	CARB	7	32.000	5.6560
148	MEDIUM	6	CARB	10	12.500	3.5000
149	MEDIUM	6	CARB	11	117.000	10.8167
150	MEDIUM	6	PFI	5	0.000	0.0000
151	MEDIUM	6	PFI	6	18.500	4.1458
152	MEDIUM	6	PFI	13	28.000	5.2915
153	MEDIUM	6	TBI	2	0.000	0.0000
154	MEDIUM	6	TBI	8	8.000	2.8284
155	MEDIUM	6	TBI	9	110.000	10.4881
156	MEDIUM	7	CARB	1	207.000	14.3875
157	MEDIUM	7	CARB	4	200.000	14.1421
158	MEDIUM	7	CARB	10	30.000	5.4772
159	MEDIUM	7	PFI	5	19.000	4.3589
160	MEDIUM	7	PFI	6	9.000	3.0000
161	MEDIUM	7	TBI	2	3.000	1.7321
162	MEDIUM	7	TBI	8	56.000	7.4833

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
AVERAGE TWD FOR EACH CAR BY TEMP BY FUEL BY SYSTEM

OBS	TEMPLEV	FUEL	SYSTEM	CAR	TWDM	SRTWDM
163	MEDIUM	7	TBI	9	24	4.8990
164	MEDIUM	8	CARB	1	98	9.8995
165	MEDIUM	8	CARB	3	49	7.0000
166	MEDIUM	8	CARB	4	21	4.5826
167	MEDIUM	8	CARB	7	20	4.4721
168	MEDIUM	8	CARB	10	19	4.3589
169	MEDIUM	8	CARB	11	91	9.5394
170	MEDIUM	8	PFI	5	0	0.0000
171	MEDIUM	8	PFI	6	12	3.4641
172	MEDIUM	8	PFI	13	0	0.0000
173	MEDIUM	8	TBI	2	1	1.0000
174	MEDIUM	8	TBI	8	15	3.8730
175	MEDIUM	8	TBI	9	25	5.0000
176	MEDIUM	9	CARB	1	61	7.8102
177	MEDIUM	9	CARB	3	97	9.8489
178	MEDIUM	9	CARB	4	38	6.1644
179	MEDIUM	9	CARB	7	8	2.8284
180	MEDIUM	9	CARB	10	28	5.2915
181	MEDIUM	9	CARB	11	154	12.4097
182	MEDIUM	9	PFI	5	6	2.4495
183	MEDIUM	9	PFI	6	1	1.0000
184	MEDIUM	9	PFI	13	1	1.0000
185	MEDIUM	9	TBI	2	8	2.8284
186	MEDIUM	9	TBI	8	8	2.8284
187	MEDIUM	9	TBI	9	45	6.7082
188	MEDIUM	10	CARB	1	150	12.2474
189	MEDIUM	10	CARB	3	94	9.6954
190	MEDIUM	10	CARB	4	83	9.1104
191	MEDIUM	10	CARB	7	0	0.0000
192	MEDIUM	10	CARB	10	13	3.6056
193	MEDIUM	10	CARB	11	41	6.4031
194	MEDIUM	10	PFI	5	10	3.1623
195	MEDIUM	10	PFI	6	1	1.0000
196	MEDIUM	10	PFI	13	0	0.0000
197	MEDIUM	10	TBI	2	0	0.0000
198	MEDIUM	10	TBI	8	12	3.4641
199	MEDIUM	10	TBI	9	25	5.0000

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
AVERAGE TWD BY TEMP BY FUEL BY SYSTEM

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
TEMPLEV=HIGH FUEL=1 SYSTEM=CARB									
TWDM	6	52.41666667	48.95244291	0	130.00000000	19.98475113	314.50000000	2396.3416667	93.391
SRTWDM	6	5.99943244	4.17988546	0	11.40175425	1.70643100	35.99659463	17.4714425	69.671
TEMPLEV=HIGH FUEL=1 SYSTEM=PFI									
TWDM	3	5.33333333	6.80685929	0	13.00000000	3.92994204	16.00000000	46.33333333	127.629
SRTWDM	3	1.61009872	1.83340481	0	3.60555128	1.05851676	4.83029615	3.36137319	113.869
TEMPLEV=HIGH FUEL=1 SYSTEM=TBI									
TWDM	3	17.16666667	22.02460745	0	42.00000000	12.71591304	51.50000000	485.08333333	128.299
SRTWDM	3	3.17738289	3.22658166	0	6.45100985	1.86286779	9.53214868	10.41082922	101.548
TEMPLEV=HIGH FUEL=2 SYSTEM=CARB									
TWDM	6	97.58333333	56.51231429	20.00000000	161.00000000	23.07105570	585.50000000	3193.6416667	57.912
SRTWDM	6	9.27073556	3.20835014	4.47213595	12.68857754	1.30980346	55.62441334	10.2935106	34.607
TEMPLEV=HIGH FUEL=2 SYSTEM=PFI									
TWDM	3	3.00000000	4.35889894	0	8.00000000	2.51661148	9.00000000	19.00000000	145.297
SRTWDM	3	1.27614237	1.43429110	0	2.82842712	0.82808835	3.82842712	2.05719096	112.393
TEMPLEV=HIGH FUEL=2 SYSTEM=TBI									
TWDM	3	15.33333333	19.29594885	0	37.00000000	11.14051664	46.00000000	372.33333333	125.843
SRTWDM	3	3.02758751	3.04147510	0	6.08276253	1.75599647	9.08276253	9.25057080	100.459
TEMPLEV=HIGH FUEL=3 SYSTEM=CARB									
TWDM	6	71.41666667	38.47910688	19.50000000	106.00000000	15.70902960	428.50000000	1480.6416667	53.880
SRTWDM	6	8.12906268	2.50770784	4.35228530	10.29563014	1.02376744	48.77437608	6.2885986	30.849
TEMPLEV=HIGH FUEL=3 SYSTEM=PFI									
TWDM	3	2.33333333	4.04145188	0	7.00000000	2.33333333	7.00000000	16.33333333	173.205
SRTWDM	3	0.88191710	1.52752523	0	2.64575131	0.88191710	2.64575131	2.33333333	173.205
TEMPLEV=HIGH FUEL=3 SYSTEM=TBI									
TWDM	3	18.66666667	16.23524972	0	29.50000000	9.37342579	56.00000000	263.58333333	86.975
SRTWDM	3	3.34638711	2.92120270	0	5.38658915	1.68655717	10.03916132	8.53342522	87.294
TEMPLEV=HIGH FUEL=4 SYSTEM=CARB									
TWDM	6	100.75000000	69.58286427	4.00000000	213.00000000	28.40700538	604.50000000	4841.7750000	69.065
SRTWDM	6	9.14183432	4.23374134	2.00000000	14.59451952	1.72841766	54.85100590	17.9245657	46.312
TEMPLEV=HIGH FUEL=4 SYSTEM=PFI									
TWDM	3	6.66666667	6.11010093	0	12.00000000	3.52766841	20.00000000	37.33333333	91.652
SRTWDM	3	2.09750958	1.84409337	0	3.46410162	1.06468780	6.29252874	3.40068034	87.918

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
AVERAGE TWD BY TEMP BY FUEL BY SYSTEM

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
TEMPLEV=HIGH FUEL=4 SYSTEM=TBI									
TWDM	3	32.33333333	46.00362305	0	85.00000000	26.56020415	97.00000000	2116.3333333	142.279
SRTWDM	3	4.22788202	4.65608619	0	9.21954446	2.68871223	12.68364607	21.6875204	110.149
TEMPLEV=HIGH FUEL=5 SYSTEM=CARB									
TWDM	6	62.83333333	57.68419772	20.00000000	177.00000000	23.54947511	377.00000000	3327.4666667	91.805
SRTWDM	6	7.38716264	3.10721697	4.46652822	13.30413470	1.26851601	44.32297586	9.6547973	42.062
TEMPLEV=HIGH FUEL=5 SYSTEM=PFI									
TWDM	3	14.00000000	24.24871131	0	42.00000000	14.0000000	42.00000000	588.00000000	173.205
SRTWDM	3	2.16024690	3.74165739	0	6.48074070	2.1602469	6.48074070	14.00000000	173.205
TEMPLEV=HIGH FUEL=5 SYSTEM=TBI									
TWDM	3	22.33333333	18.48197320	1.00000000	33.50000000	10.67057220	67.00000000	341.58333333	82.755
SRTWDM	3	3.72748428	2.43493872	1.00000000	5.68245284	1.40581252	11.18245284	5.92892655	65.324
TEMPLEV=HIGH FUEL=6 SYSTEM=CARB									
TWDM	6	163.19444444	106.74483681	28.00000000	348.00000000	43.57830714	979.16666667	11394.460185	65.410
SRTWDM	6	12.06135650	4.37094483	5.23606798	18.59605133	1.78443076	72.36813902	19.105159	36.239
TEMPLEV=HIGH FUEL=6 SYSTEM=PFI									
TWDM	3	3.16666667	5.48482756	0	9.50000000	3.16666667	9.50000000	30.08333333	173.205
SRTWDM	3	1.00917350	1.74793078	0	3.02752051	1.00917350	3.02752051	3.05529348	173.205
TEMPLEV=HIGH FUEL=6 SYSTEM=TBI									
TWDM	3	38.77777778	30.50379454	8.00000000	69.00000000	17.61137309	116.33333333	930.48148148	78.663
SRTWDM	3	5.77548775	2.75967756	2.82842712	8.29875399	1.59330058	17.32646326	7.61582026	47.783
TEMPLEV=HIGH FUEL=7 SYSTEM=CARB									
TWDM	6	161.66666667	86.32419514	5.00000000	237.00000000	35.24170500	970.00000000	7451.8666667	53.396
SRTWDM	6	11.88661458	4.94470145	2.23606798	15.39480432	2.01866592	71.31968751	24.4500725	41.599
TEMPLEV=HIGH FUEL=7 SYSTEM=PFI									
TWDM	3	21.66666667	34.12232896	0	61.00000000	19.70053581	65.00000000	1164.3333333	157.488
SRTWDM	3	3.27008323	4.05707204	0	7.81024968	2.34235164	9.81024968	16.4598335	124.066
TEMPLEV=HIGH FUEL=7 SYSTEM=TBI									
TWDM	3	59.83333333	57.30255957	26.50000000	126.00000000	33.08364819	179.50000000	3283.5833333	95.770
SRTWDM	3	7.09366089	3.58176954	4.85985800	11.22497216	2.06793561	21.28098268	12.8290731	50.493
TEMPLEV=HIGH FUEL=8 SYSTEM=CARB									
TWDM	6	151.22222222	89.73013037	30.00000000	230.00000000	36.63217233	907.33333333	8051.4962963	59.337
SRTWDM	6	11.57907618	4.42910967	5.07071421	15.16058612	1.80817645	69.47445706	19.6170125	38.251

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
AVERAGE TWD BY TEMP BY FUEL BY SYSTEM

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
TEMPLEV=HIGH FUEL=8 SYSTEM=PFI									
TWDM	3	8.16666667	7.28583100	0	14.00000000	4.20647649	24.50000000	53.08333333	89.214
SRTWDM	3	2.31634667	2.02247831	0	3.73205081	1.16767840	6.94904001	4.09041853	87.313
TEMPLEV=HIGH FUEL=8 SYSTEM=TBI									
TWDM	3	33.33333333	42.33505792	5.00000000	82.00000000	24.44267670	100.00000000	1792.3333333	127.008
SRTWDM	3	4.74595394	3.86338406	1.58113883	9.05117172	2.23052584	14.23786183	14.9257365	81.404
TEMPLEV=HIGH FUEL=9 SYSTEM=CARB									
TWDM	6	177.66666667	95.02140110	45.00000000	338.00000000	38.79232456	1066.0000000	9029.0666667	53.483
SRTWDM	6	12.87896664	3.76279974	6.70820393	18.38477631	1.53615656	77.2737998	14.1586619	29.217
TEMPLEV=HIGH FUEL=9 SYSTEM=PFI									
TWDM	3	18.66666667	13.20353488	7.00000000	33.00000000	7.62306442	56.00000000	174.33333333	70.733
SRTWDM	3	4.13010465	1.55349713	2.64575131	5.74456265	0.89691199	12.39031396	2.41335334	37.614
TEMPLEV=HIGH FUEL=9 SYSTEM=TBI									
TWDM	3	45.66666667	56.88878038	2.00000000	110.00000000	32.84475267	137.00000000	3236.3333333	124.574
SRTWDM	3	5.63410068	4.57005079	1.41421356	10.48808848	2.63852006	16.90230204	20.8853643	81.114
TEMPLEV=HIGH FUEL=10 SYSTEM=CARB									
TWDM	6	120.36111111	63.93472510	22.50000000	187.00000000	26.10124222	722.16666667	4087.6490741	53.119
SRTWDM	6	10.41006959	3.35738712	4.74077759	13.35000564	1.37064755	62.46041755	11.2720483	32.251
TEMPLEV=HIGH FUEL=10 SYSTEM=PFI									
TWDM	3	31.50000000	52.40944571	0	92.00000000	30.25860750	94.50000000	2746.7500000	166.379
SRTWDM	3	3.69722102	5.15953827	0	9.59166305	2.97886081	11.09166305	26.6208351	139.552
TEMPLEV=HIGH FUEL=10 SYSTEM=TBI									
TWDM	3	49.66666667	35.16153201	10.00000000	77.00000000	20.30051997	149.00000000	1236.3333333	70.795
SRTWDM	3	6.47043122	2.91888061	3.16227766	8.68303643	1.68521650	19.41129367	8.5198640	45.111
TEMPLEV=HIGH FUEL=11 SYSTEM=CARB									
TWDM	4	111.37500000	57.88404357	30.50000000	167.00000000	28.94202178	445.50000000	3350.5625000	51.972
SRTWDM	4	10.15964761	3.25922374	5.45356551	12.92284798	1.62961187	40.63859046	10.6225394	32.080
TEMPLEV=HIGH FUEL=11 SYSTEM=PFI									
TWDM	1	1.50000000	.	1.50000000	1.50000000	.	1.50000000	.	.
SRTWDM	1	1.20710678	.	1.20710678	1.20710678	.	1.20710678	.	.
TEMPLEV=HIGH FUEL=11 SYSTEM=TBI									
TWDM	1	11.00000000	.	11.00000000	11.00000000	.	11.00000000	.	.
SRTWDM	1	3.31662479	.	3.31662479	3.31662479	.	3.31662479	.	.

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
AVERAGE TWD BY TEMP BY FUEL BY SYSTEM

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
TEMPLEV=HIGH FUEL=12 SYSTEM=PFI									
TWDM	1	0	.	0	0	.	0	.	.
SRTWDM	1	0	.	0	0	.	0	.	.
TEMPLEV=HIGH FUEL=13 SYSTEM=CARB									
TWDM	4	120.25000000	22.15663934	88.00000000	137.00000000	11.07831967	481.00000000	490.91666667	18.425
SRTWDM	4	10.91344444	1.04784758	9.38083152	11.70469991	0.52392379	43.65377777	1.09798455	9.601
TEMPLEV=MEDIUM FUEL=1 SYSTEM=CARB									
TWDM	6	44.50000000	42.97324740	4.00000000	113.00000000	17.54375482	267.00000000	1846.7000000	96.569
SRTWDM	6	5.70029744	3.31080726	2.00000000	10.50224250	1.35163141	34.20178465	10.9614447	58.081
TEMPLEV=MEDIUM FUEL=1 SYSTEM=PFI									
TWDM	2	6.00000000	2.82842712	4.00000000	8.00000000	2.00000000	12.00000000	8.00000000	47.140
SRTWDM	2	2.41421356	0.58578644	2.00000000	2.82842712	0.41421356	4.82842712	0.34314575	24.264
TEMPLEV=MEDIUM FUEL=5 SYSTEM=CARB									
TWDM	2	0	0	0	0	0	0	0	.
SRTWDM	2	0	0	0	0	0	0	0	.
TEMPLEV=MEDIUM FUEL=5 SYSTEM=PFI									
TWDM	1	0	.	0	0	.	0	.	.
SRTWDM	1	0	.	0	0	.	0	.	.
TEMPLEV=MEDIUM FUEL=5 SYSTEM=TBI									
TWDM	1	16.00000000	.	16.00000000	16.00000000	.	16.00000000	.	.
SRTWDM	1	4.00000000	.	4.00000000	4.00000000	.	4.00000000	.	.
TEMPLEV=MEDIUM FUEL=6 SYSTEM=CARB									
TWDM	6	88.91666667	69.12048650	12.50000000	176.00000000	28.21832049	533.50000000	4777.6416667	77.736
SRTWDM	6	8.64355568	3.97268703	3.50000000	13.26649916	1.62184269	51.86133406	15.7822422	45.961
TEMPLEV=MEDIUM FUEL=6 SYSTEM=PFI									
TWDM	3	15.50000000	14.23[illegible]03087	0	28.00000000	8.22090830	46.50000000	202.75000000	91.865
SRTWDM	3	3.14575131	2.78388218	0	5.29150262	1.60727513	9.43725393	7.75000000	88.497
TEMPLEV=MEDIUM FUEL=6 SYSTEM=TBI									
TWDM	3	39.33333333	61.32971004	0	110.00000000	35.40872460	118.00000000	3761.3333333	155.923
SRTWDM	3	4.43883854	5.42633105	0	10.48808848	3.13289360	13.31651561	29.4450687	122.247
TEMPLEV=MEDIUM FUEL=7 SYSTEM=CARB									
TWDM	3	145.66666667	100.23139894	30.00000000	207.00000000	57.86862516	437.00000000	10046.333333	68.809
SRTWDM	3	11.33561859	5.07500018	5.47722558	14.38749457	2.93005272	34.00685577	25.755627	44.770

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
AVERAGE TWD BY TEMP BY FUEL BY SYSTEM

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
TEMPLEV=MEDIUM FUEL=7 SYSTEM=PFI									
TWDM	2	14.00000000	7.07106781	9.00000000	19.00000000	5.00000000	28.00000000	50.00000000	50.508
SRTWDM	2	3.67944947	0.96088666	3.00000000	4.35889894	0.67944947	7.35889894	0.92330317	26.115
TEMPLEV=MEDIUM FUEL=7 SYSTEM=TBI									
TWDM	3	27.66666667	26.68957340	3.00000000	56.00000000	15.40923244	83.00000000	712.33333333	96.468
SRTWDM	3	4.70478169	2.88054576	1.73205081	7.48331477	1.66308387	14.11434507	8.29754389	61.226
TEMPLEV=MEDIUM FUEL=8 SYSTEM=CARB									
TWDM	6	49.66666667	36.57139137	19.00000000	98.00000000	14.93020801	298.00000000	1337.4666667	73.634
SRTWDM	6	6.64208292	2.58055833	4.35889894	9.89949494	1.05350853	39.85249754	6.6592813	38.852
TEMPLEV=MEDIUM FUEL=8 SYSTEM=PFI									
TWDM	3	4.00000000	6.92820323	0	12.00000000	4.00000000	12.00000000	48.00000000	173.205
SRTWDM	3	1.15470054	2.00000000	0	3.46410162	1.15470054	3.46410162	4.00000000	173.205
TEMPLEV=MEDIUM FUEL=8 SYSTEM=TBI									
TWDM	3	13.66666667	12.05542755	1.00000000	25.00000000	6.96020434	41.00000000	145.33333333	88.210
SRTWDM	3	3.29099445	2.06253080	1.00000000	5.00000000	1.19080271	9.87298335	4.25403331	62.672
TEMPLEV=MEDIUM FUEL=9 SYSTEM=CARB									
TWDM	6	64.33333333	53.48893067	8.00000000	154.00000000	21.83676818	386.00000000	2861.0666667	83.143
SRTWDM	6	7.39218748	3.40979136	2.82842712	12.40967365	1.39204149	44.35312487	11.6266771	46.127
TEMPLEV=MEDIUM FUEL=9 SYSTEM=PFI									
TWDM	3	2.66666667	2.88675135	1.00000000	6.00000000	1.66666667	8.00000000	8.33333333	108.253
SRTWDM	3	1.48316325	0.83686329	1.00000000	2.44948974	0.48316325	4.44948974	0.70034017	56.424
TEMPLEV=MEDIUM FUEL=9 SYSTEM=TBI									
TWDM	3	20.33333333	21.36195996	8.00000000	45.00000000	12.33333333	61.00000000	456.33333333	105.059
SRTWDM	3	4.12168606	2.23999018	2.82842712	6.70820393	1.29325894	12.36505818	5.01755603	54.346
TEMPLEV=MEDIUM FUEL=10 SYSTEM=CARB									
TWDM	6	63.50000000	56.35867280	0	150.00000000	23.00833182	381.00000000	3176.3000000	88.754
SRTWDM	6	6.84365292	4.47183381	0	12.24744871	1.82561851	41.06191752	19.9972977	65.343
TEMPLEV=MEDIUM FUEL=10 SYSTEM=PFI									
TWDM	3	3.66666667	5.50757055	0	10.00000000	3.17979734	11.00000000	30.33333333	150.206
SRTWDM	3	1.38742589	1.61634591	0	3.16227766	0.93319775	4.16227766	2.61257411	116.500
TEMPLEV=MEDIUM FUEL=10 SYSTEM=TBI									
TWDM	3	12.33333333	12.50333289	0	25.00000000	7.21880261	37.00000000	156.33333333	101.378
SRTWDM	3	2.82136721	2.56121663	0	5.00000000	1.47871911	8.46410162	6.55983064	90.779

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
AVERAGE TWD FOR ALL CARS BY TEMP BY FUEL

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
TEMPLEV=HIGH FUEL=1									
TWDM	12	31.83333333	40.83076677	0	130.00000000	11.78682709	382.00000000	1667.1515152	128.264
SRTWDM	12	4.19658662	3.78500899	0	11.40175425	1.09263798	50.35903946	14.3262930	90.193
TEMPLEV=HIGH FUEL=2									
TWDM	12	53.37500000	60.62669866	0	161.00000000	17.50142040	640.50000000	3675.5965909	113.586
SRTWDM	12	5.71130025	4.57979131	0	12.68857754	1.32207187	68.53560299	20.9744885	80.188
TEMPLEV=HIGH FUEL=3									
TWDM	12	40.95833333	42.09915694	0	106.00000000	12.15297980	491.50000000	1772.3390152	102.785
SRTWDM	12	5.12160739	3.94074723	0	10.29563014	1.13759574	61.45928871	15.5294888	76.944
TEMPLEV=HIGH FUEL=4									
TWDM	12	60.12500000	66.95253577	0	213.00000000	19.32753227	721.50000000	4482.6420455	111.356
SRTWDM	12	6.15226506	4.80394963	0	14.59451952	1.38678081	73.82718071	23.0779320	78.084
TEMPLEV=HIGH FUEL=5									
TWDM	12	40.50000000	47.27674808	0	177.00000000	13.64762162	486.00000000	2235.0909091	116.733
SRTWDM	12	5.16551412	3.70558369	0	13.30413470	1.06970987	61.98616940	13.7313505	71.737
TEMPLEV=HIGH FUEL=6									
TWDM	12	92.08333333	105.08746958	0	348.00000000	30.33613943	1105.0000000	11043.376263	114.122
SRTWDM	12	7.72684357	5.84963618	0	18.59605133	1.68864451	92.7221228	34.218243	75.705
TEMPLEV=HIGH FUEL=7									
TWDM	12	101.20833333	91.55362520	0	237.00000000	26.42925508	1214.5000000	8382.0662879	90.461
SRTWDM	12	8.53424332	5.54008953	0	15.39480432	1.59928609	102.4109199	30.6925920	64.916
TEMPLEV=HIGH FUEL=8									
TWDM	12	85.98611111	93.40398998	0	230.00000000	26.96340938	1031.8333333	8724.3053451	108.627
SRTWDM	12	7.55511324	5.55369813	0	15.16658612	1.60321456	90.6613589	30.8435629	73.509
TEMPLEV=HIGH FUEL=9									
TWDM	12	104.91666667	102.94346050	2.00000000	338.00000000	29.71721732	1259.0000000	10597.356061	98.119
SRTWDM	12	8.88053465	5.33115416	1.41421356	18.38477631	1.53897164	106.5664159	28.421205	60.032
TEMPLEV=HIGH FUEL=10									
TWDM	12	80.47222222	66.05296441	0	187.00000000	19.06784839	965.66666667	4362.9941077	82.082
SRTWDM	12	7.74694786	4.50539364	0	13.35090564	1.30059512	92.96337427	20.2985719	58.157
TEMPLEV=HIGH FUEL=11									
TWDM	6	76.33333333	70.47245325	1.50000000	167.00000000	28.77025856	458.00000000	4966.3666667	92.322
SRTWDM	6	7.52705367	4.84271126	1.20710678	12.92284798	1.97702859	45.16232203	23.4518523	64.337

1985 CRC HOT START AND DRIVEAWAY TEST PROGRAM
AVERAGE TWD FOR ALL CARS BY TEMP BY FUEL

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
TEMPLEV=HIGH FUEL=12									
TWDM	1	0	.	0	0	.	0	.	.
SRTWDM	1	0	.	0	0	.	0	.	.
TEMPLEV=HIGH FUEL=13									
TWDM	4	120.25000000	22.15663934	88.00000000	137.00000000	11.07831967	481.00000000	490.91666667	18.425
SRTWDM	4	10.91344444	1.04784758	9.38083152	11.70469991	0.52392379	43.65377777	1.09798455	9.601
TEMPLEV=MEDIUM FUEL=1									
TWDM	8	34.87500000	40.47022715	4.00000000	113.00000000	14.30838603	279.00000000	1637.8392857	116.044
SRTWDM	8	4.87877647	3.19257823	2.00000000	10.59224250	1.12874686	39.03021177	10.1925558	65.438
TEMPLEV=MEDIUM FUEL=5									
TWDM	4	4.00000000	8.00000000	0	16.00000000	4.00000000	16.00000000	64.00000000	200.000
SRTWDM	4	1.00000000	2.00000000	0	4.00000000	1.00000000	4.00000000	4.00000000	200.000
TEMPLEV=MEDIUM FUEL=6									
TWDM	12	58.16666667	63.25645254	0	176.00000000	18.26056495	698.00000000	4001.3787879	108.750
SRTWDM	12	6.21792530	4.53685567	0	13.26649916	1.30967742	74.61510360	20.5830594	72.964
TEMPLEV=MEDIUM FUEL=7									
TWDM	8	68.50000000	84.83092428	3.00000000	207.00000000	29.99226091	548.00000000	7196.2857143	123.841
SRTWDM	8	6.93501247	4.82914982	1.73205081	14.38749457	1.70736229	55.48009978	23.3206880	69.634
TEMPLEV=MEDIUM FUEL=8									
TWDM	12	29.25000000	33.32518840	0	98.00000000	9.62015325	351.00000000	1110.5681818	113.932
SRTWDM	12	4.43246521	3.23670745	0	9.89949494	0.93435696	53.18958251	10.4762751	73.023
TEMPLEV=MEDIUM FUEL=9									
TWDM	12	37.91666667	46.78472620	1.00000000	154.00000000	13.50558713	455.00000000	2188.8106061	123.388
SRTWDM	12	5.09730607	3.60819333	1.00000000	12.40967365	1.04159570	61.16767280	13.0190591	70.786
TEMPLEV=MEDIUM FUEL=10									
TWDM	12	35.75000000	48.24958785	0	150.00000000	13.92845627	429.00000000	2328.0227273	134.964
SRTWDM	12	4.47402473	4.14287156	0	12.24744871	1.19594400	53.68829680	17.1633848	92.598